AN EVALUATION OF THE SEABEE TRAINING PROGRAM AT PORT HUENEME, CALIFORNIA

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A46

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AN EVALUATION OF THE SEABEE TRAINING PROGRAM
AT PORT HUENEME, CALIFORNIA

A THESIS
SUBMITTED TO THE
SCHOOL OF EDUCATION AND
THE COMMITTEE ON GRADUATE STUDY
OF
LELAND STANFORD JUNIOR UNIVERSITY
IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS
FOR THE DEGREE
OF
MASTER OF ARTS

By
Nelson Richard Anderson
June, 1950

Thesis
A46

12967

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CHAPTER I

INTRODUCTION

Origin of the Seabees

When the coming of World War II cast its shadows upon the United States in the late thirties, one of the many studies undertaken to evaluate the status of defense in our Pacific possessions resulted in the Hepburn Report[1] which was completed in December, 1938. This report recommended that certain Pacific bases be improved as operating activities and be made more defensible in case of emergency. In implementing this report, Congress voted the necessary funds, and contracts for improvements were let to combinations of major civilian contractors. The first contract was signed on 5 August 1939 and work was soon in progress in places like Pearl Harbor, Midway, Wake, Johnson, Palmyra, Kodiak and Sitka. Work went on rapidly, but as the emergency became more grave, appropriations soon outstripped the ability of the contractors to keep pace.

Until the outbreak of the war, the civilian contractors did an excellent job. But the attack on Pearl

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[1] Civil Engineer Corps Officers' Guide - U. S. Naval School (CEC Officers) Naval Construction Battalion Center - Port Hueneme, Calif. 1948, Chap. VI, p. 1.

Harbor by the Japanese posed problems which soon made the continued use of civilians at advanced bases impossible. The capture of Wake Island and the contractors' force employed there, focused public attention on the intolerable position in which these men were being placed. Unarmed they were defenseless against the enemy; armed, without being organized into actual military units, they could be considered guerillas, and as such could be executed upon capture.

Three weeks after Pearl Harbor, on 28 December, 1941, the Seabees were born when Admiral Moreell,[1] Chief of the Bureau of Yards and Docks, recommended that early steps should be taken towards organization of construction forces into military units trained in military discipline and familiar with combat duties so that they could protect themselves in order that construction on advance bases in combat zones could be carried out satisfactorily. This request was authorized by the Chief of Naval Personnel on 5 January 1942. The first authorization was for 3000 men, but subsequent authorities expanded the Seabees to 250,000 officers and men.

A resume of the heroic deeds and superhuman construction feats accomplished is far beyond the limits of this study. Official reports contain many references

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[1] Ibid., Chap. VI, p. 2.

attesting to the ability and ingenuity of the Seabees in all theatres of the last war. This new addition of the Navy, by the virtue of its strength in the construction skills which the men already possessed upon entering the service, soon was able to do its share and more on the long road to victory. Morale is always a strong factor in the success of any outfit, and the faith and ability of these seasoned construction men carried over, from the dams, the roads, the oil fields, and all the other places where this breed labor, into the Seabees and was the driving force behind the miracles created in the Solomons, New Guinea, at Salerno, Omaha, and the other battlegrounds of the war.

Post War Status

The declaration of peace in 1945 found the United States in possession of a considerable number of naval bases throughout the world. Considerable difficulty was experienced in obtaining civilian personnel for the necessary upkeep and repair of facilities in certain of these areas and it was decided to make permanent the Construction Battalion units for the accomplishment of this purpose.

Seabee units are stationed at the present time on Guam, Okinawa, Philippine Islands, Alaska, Kwajalin, French Morroco, Greenland, Puerto Rico, Newfoundland, Trinidad, and an unit is attached to each of the two amphibious commands for training purposes. These units are used almost entirely for maintenance projects and are far below the

the wartime strength of such units.

The Problem

As the demobilization of the Seabees was effected after V-J Day, the level of ability of the men remaining in the units dropped lower and lower. In October 1946, the units reached rock bottom and the maintenance of overseas bases became a major problem. Although all services were seriously handicapped by demobilization, the Seabees suffered to the greatest extent inasmuch as it was a war-borned unit, staffed exclusively by reserves, and could not offer the rosy promises that the booming construction industry dangled before the skilled artisans that comprised the now famous "can-do" boys.

The task of developing the skills and the knowledge necessary for the post-war Seabees to carry on the hard won traditions fell to the U.S. Naval Schools, Construction situated at Port Hueneme, California. This mission proved to be of the utmost difficulty and criticisms from the field units stressed the inability of graduates to do the work assigned to the units overseas.

Numerous studies were made with the view towards improving the end product of Hueneme's schools, but in the final analysis it was found each time that the period that could be allotted to training was totally insufficient to produce anything comparable to a "journeyman" craftsman.

Remembering that earlier battalions were composed to a large measure by "master" craftsmen, it is easy to see why the post-war battalions found it difficult to emulate the feats of their predecessors.

Evaluations of Hueneme's program have covered in great detail the curriculum of each of the eight schools and it is believed that little improvement can be made along that line. Intensive self-examination of teaching techniques, visual aids, materials, equipment, and the motivation provided for students and instructors has made further investigation along these lines of doubtful value.

The task of raising the skill of the men of the Seabees still remains one of the most imposing problems facing the Civil Engineers Corps of the Navy today. The constant drain of its outstanding members by industry, the lack of adequate supervision in the field, and the apparent inability of present training methods to furnish sufficiently trained men requires an investigation of new philosophies of training of industrial workers with the goal of devising a new manner of readying Seabees for work in the field if such a philosophy exists.

The Purpose

The purpose of this thesis is first, to survey the general field of education of industrial and construction workers; secondly, to evaluate the training procedures and

theories now in effect at the Naval Schools, Construction, Port Hueneme, California in the light of those practices and theories found by this survey; and thirdly, to recommend procedures evident from the results of that evaluation.

From the results of this study a comparison can be made of Hueneme's program with those of institutions preparing workers for similar occupations in civilian fields. Should new techniques, or a new philosophy be uncovered that would ease the problem of training Seabees, the Bureau of Yards and Docks and the Bureau of Naval Personnel could utilize it to solve this difficult problem common to all parts of the post-war Navy.

This problem, unlike most current military problems, is essentially one of peacetime. During a national emergency the service has access to all of the skilled artisans of the country and the present problem fades completely from the scene. Yet by solving this peacetime problem, the Navy will in part alleviate the critical shortage of skilled workers that is all too prevalent even in the midsts of the deepest depression. The solution will place the Construction Battalions on a firm basis, offering a substructure on which to build in advent of another emergency and will eliminate the makeshift expedients characteristic of the early units of World War II.

Limits of the Study

The field covered by this report is too large to be tackled in detail by a report of this type. An investigation of any one of the training programs which is comparable to the instruction given at Hueneme is worthy of a series of reports in itself. Apprenticeship, junior college, vocational and trade schools, other service schools, and industry all conduct programs that are comparable to that given in order to train Seabees.

Therefore it has been necessary to scan field and determine the current trends, practices and philosophies now in effect. No attempt was made to delve deeply into the factors that underlie the adoption of these instructional methods. In order to obtain representative samples of current practices, it was necessary to restrict the research of this study to information already collected and published. This restriction naturally limits the information that is included but on the other hand this procedure eliminates special procedures that are suited only to specific institutions.

Since there are sixteen different courses of instruction at Hueneme, little attempt has been made, beyond selecting outstanding illustrations, to check the courses item by item. Rather, the approach has been to select trends and philosophies that seem to coincide or be in direct opposition. From comparisons of this type it is possi-

ble to select trends and philosophies that will improve the instruction at Hueneme. Yet there are many details that are not susceptible to detection by this method. It will be profitable to follow up this study by detail investigation of such fields that this report seems to indicate that have promise.

There are many schools and colleges which offer trade and vocational training. It is patently impossible to evaluate the quality of instruction that is given at each of these institutions. Therefore, it was necessary for the purpose of this study to use evaluations of responsible investigators who, although of proven quality, are not writing from the viewpoint in which this study is concerned. It may be that additional investigation would uncover procedures that would prove of value to the program at Hueneme.

Method of Conducting the Study

The study consisted of a survey of the three major fields of training for industry. The first field to be considered was the apprenticeship program. The library was searched for pertinent literature and contacts were made with labor unions and the State of California Labor Council. No attempt was made to make any survey of the practices of apprenticeship programs in foreign countries. Considerable information is published by the United States Department of Labor and much of it useful in evaluating the Hueneme program.

The second field was that of the vocational, trade and junior college programs and the catalogues of the junior colleges were inspected for information as to the courses offered and the philosophies basic to the organization of this system of training. Much information was available in the library on the vocational and trade schools. No attempt was made to circulate a questionnaire among the various types of schools in an attempt to determine any specific references to Seabee training other than that which can be drawn from general information.

The final field studied was that of industry. It was especially fortunate in that the dissertation of Danaher[1] and the book of Beatty[2] were available for information on this subject. Since the last war is still fresh in memory, much information is on file as to the methods used to train the vast labor force required to man the industrial machine built to insure victory.

Related Studies

This evaluation of the training program at Port Hueneme is of course of limited interest and investigations of this program have been limited to official studies to

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1. Eugene Ives Danaher, "The Federal Training Within Industry Program," Unpublished Doctoral Dissertation, Graduate School of Business, Stanford University, Stanford, California, 1946.

2. Albert J. Beatty, "Corporation Schools, Unpublished Doctoral Dissertation, Graduate School, University of Illinois, Champagne, Illinois, 1917.

determine improvements and alternations in the program. These studies have been restricted to an investigation of the curriculum to determine its suitability to meet the requirements of the field and to train personnel to meet the qualifications for advancement in rating as set by the Bureau of Naval Personnel.

These studies have occurred at intervals over the last five years and have resulted in bringing the curriculum to the present status and is believed by the directors of the training program to be the best available within the time available for training personnel. However, none of these studies investigated current practices in civilian fields and only the last study, completed in January, 1950 looked into the training programs in effect at schools in other branches of the services.

No directly applicable studies for the comparison of a service program with that of civilian institutions were found in reviewing the literature contained in the Stanford libraries. However, numerous studies were found evaluating each type of system in which similar programs are in effect at Hueneme. The following condensations briefly describe the results and conclusions obtained by the more interesting of these studies.

Apprenticeship

Moss, in 1936, made a study of the project method

of teaching in the Apprentice schools of United States Navy Yards.[1] The purpose of the study was first, to show the need for related instruction as a part of the apprentice training program in the U.S. Navy Yards; second, to show the use of the Project Method in the field of apprentice training in the mechanical trades; third, to develop a technique for constructing project curricula in the related subjects; and lastly, to set up criteria and precedents for the guidance of teachers in applying the technique to similar programs of industrial education. Ross concluded that the dearth of adequately trained men seems to have convinced American industry that the training of apprentices is a prudent and essential business investment. He found that emphasis should be placed upon the related technical instruction, yet that instruction must of necessity closely correlate shop and school activities. Inflexible patterns of traditional high school organization strongly influence curriculum building and teaching procedures in the related subjects courses and has restricted the integration of manipulative and related technical instruction as advocated by vocational educational authorities. The use of project curricula in the training of

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[1] Louis [illegible]. Ross, *The Project Method Applied to Curriculum Construction in the Apprentice Schools of the United States Navy Yards*, Philadelphia, Penn.: Doctoral Dissertation, Teacher's College, Temple University, 1949.

apprentices in industry appeared to warrant experimentation.

In 1949, Niemela made a comprehensive study of apprenticeship in Contra Costa and Alameda Counties of California.[1] The purpose of this study was to investigate the apprentice training program, particularly from the guidance point of view. Niemela found that there was a very inadequate understanding of the excellent post high school educational and occupational opportunities open through an apprenticeship prevalent throughout the community. He recommended that a re-appraisal of the preapprentice training program be undertaken to determine just where the program should be placed - in high school, vocational school or junior college. Niemela was concerned with the high percentage of "fallouts" in the programs and believed that better indoctrination would help to alleviate this situation.

Vocational Education

Shephard, in 1948, surveyed the vocational education systems of New York and California to determine the scope, length, individual attention to students of each of

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1. Albert W. Niemela, *Industrial Apprenticeship in Contra Costa and Alameda Counties, California.* Stanford University, California: Unpublished Doctoral Dissertation, School of Education, Stanford University, 1949.

these programs.[1] He further essayed to determine how completely these programs were meeting the needs of their communities. Shephard found that the junior colleges were wider in scope and more flexible than institutions of the older type. Since California's junior colleges are operated under local control rather than under the close supervision of the State Department of Education, they meet the needs of the community to a greater degree than can the institutes of New York.

In 1938, Russell and Associates prepared a staff study on Vocational Education for the Advisory Committee on Education.[2] This study undertook to survey in a fairly broad way the whole plan of organization for the federally reimbursed program of vocational education, the outcomes of this service, the needs of the country for occupational preparation, and the manner in which those needs may best be met. Russell found that the federally supported program has to a considerable extent become a federally dictated program in many States, and recommended a reduction in the control of the program by the Federal Government. The

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1. Reginald [illegible]. Shephard, Vocational Education in New York State Technical Institutes and California Public Junior Colleges, Stanford, California: Unpublished Master Thesis, School of Education, Stanford University, 1943.

2. John D. Russell and Associates. Vocational Education, Washington, D. C.: The Advisory Committee on Education Government Printing Office, 1938.

program in trades and industries was found to have given rise to more complaints than any of the other fields; the chief difficulty being that the program has been carried on without sufficient regard to the best interests of the present and future workers. Russell recommended that training should be given in a related family of occupations rather than for specific tasks, and must include, in addition to training, guidance and placement. Education of this type should be largely limited to the later years of secondary schools and the junior colleges.

Eells has written several books on junior college programs, especially those instructing in terminal courses.[1] He has surveyed the training given in all of the various fields and justifies the terminal courses. He is the leading expounder of the teaching philosophy behind the inclusion of terminal courses in the junior college program.

Industry In-Service Training Program

Danaher, in 1946, completed a study of the Federal Training Within Industry Program that made such substantial contributions to the war effort.[2] He made a complete survey of the efforts of the four subprograms of this agency,

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1. Walter C. Eells, Present Status of Junior College Terminal Education, Minasha, Wis.: George Banta Publishing Co., 1942.

2. Eugene Ives Danaher, The Federal Training Within Industry Program, Stanford University: Unpublished doctoral dissertation, 1946, Graduate School of Business.

the job instructor training, the job relations training, job methods training, and program development. Danaher concluded that these programs had contributed excellent ideas and procedures to the educational processes of this nation and recommended that further study should be initiated so that the gains could be incorporated into the nation's formal educational institutions. However, he cautioned against governmental encroachment upon the administration and supervision of our schools and warned of the dangers that ensue from a state school system.

Beatty made a study of the corporation school in 1912.[1] Although this study is quite old it gives a good picture of the school which was devised by industry to meet the shortcomings of the educational system at the turn of the century. In his conclusions, Beatty pointed out the desirability of formal educational institutions taking over the mission of the corporation school so as to give better service to the community, the student and industry.

Summary

The victory in World War II was made possible by the success of the training programs introduced by the national government, various state agencies, industry, colleges, municipal and local educational committees and boards. Since this training took a leading role in the

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[1] *Op. cit.*, Beatty, *Corporation Schools*.

last decade, much has been written on the subject and well formulated philosophies have been developed as to the proper method of training personnel for industry.

One of the outstanding programs of training workers for skilled craftsmen is in effect under the supervision of the State of California. This program is a joint undertaking, with labor, management, and the State helping to administrate and supervise the system. The State Department of Industrial Relations, Division of Apprenticeship Standards supervises the training of the worker on the job. The schedule of work processes is examined and the hours of work and pay rates are set by bargaining between labor and management. The State Department of Education, Bureau of Trade and Industrial Education supervises the instruction given in related subjects during the time allotted to formalized training.[1]

Elaborate publications have been developed and are available for the instruction and testing of apprentices. The Bureau of Trade and Industrial Education is convinced that technical and vocational training can never replace apprenticeship. The Bureau insists that the transfer of learning obtained from a class room situation is very small even at the best obtainable conditions. Experience at the Laney Technical High School has shown that extended in-

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[1] The Apprenticeship Law, Shelley Maloney Apprentice Labor Standards Act of 1939, Stats. 1939, Chap. 220.

struction in school shops has tended to make students lax and to develop bad habits. The Bureau considers that the prime mission of these institutions is essentially that of guidance and not of instruction. The motivation and atmosphere obtained under formal school conditions is far from perfect and it is believed that instruction on the job is the only type of training that will provide the motivation and atmosphere required for successful learning in this field.

Junior college and higher institutions of learning are turning more and more to instruction of the terminal type.[1] Social changes and technological advancements have completely upset the old social order and much concern is arising from the lack of placement of high school and college graduates in positions of administration and supervision. More and more educational leaders are convinced that emphasis must be placed upon the training of personnel for industry and business which is the only field that offers opportunity for placement at this time. Terminal curricula are becoming the main field of effort for junior colleges. Colleges are turning more and more to extension and unit courses. The appearance of the technician has heralded this innovation in education.

Training in industry has been reduced drastically

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1. *Op. cit.*, W. C. Eells.

since the end of the war. However, our industrial leaders were shown the value of proper training during the late hostilities and a good sound plan of training can be sold to them in order to maintain the labor market at peak ability.

In summing up the mass of information available it appears that present problems facing labor, industry, and educational agencies are similar to those facing the Bureau of Yards and Docks and that considerable progress has been made towards a solution. It will be of inestimable value to the service to survey carefully the conclusions of the various programs and attempt to use them in the Seabee training plans now in effect.

CHAPTER II

DESCRIPTION OF THE SEABEE PROGRAM AT PORT HUENEME

Introduction

Upon the conception of the Construction Battalions, it was apparent that the formation of experienced construction workers, averaging more than thirty years of age, into efficient military construction units presented problems both difficult and unique. Since recruiting was expected to produce a body of skilled tradesmen, there was little need for trade-school training, but the lack of military experience possessed by the new men indicated the phase of training that should be emphasized. In addition to the military training that would be required for each Seabee unit, it was felt that training should be provided for small groups of specialists in each battalion on the operation and maintenance of such specialized equipment used on advanced bases as pontoons, stills and purifiers, and mobile generators.[1]

As the war progressed, the specialities in which small groups were trained became larger and larger. The

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[1] U. S. Naval Training Bulletin, Bureau of Naval Personnel, U.S. Navy - Seabee Training at Port Hueneme, Lt. [illegible] Minassian and Ens. [illegible] Ward, p. 11.

later battalions did not possess the skills so evident in the first wave of volunteers. The job of selecting men for these schools became increasingly difficult and by V-J Day, new battalions were being made by adding new recruits to groups of seasoned men drawn from outfits already in the field. In other words the potential of skilled labor had been exhausted and the major problem facing the training officers was the imparting of sufficient knowledge to raw recruits to enable them to perform creditably in the field. Fortunately the Japanese surrender made this task subordinate to demobilization and delayed the need for solution until the service returned to a peacetime basis and considerable more thought and time expended in its solution.

By October, 1945, the apparent disintegration of the Seabees became a problem of growing concern in the Bureau of Yards and Docks. The fact that the Construction Battalions were essentially a reserve organization, that the men were older than usual, and that all of their service had been spent overseas, made demobilization even more rapid under the discharge in effect than in other branches of the service. Units in the field were virtually stripped of qualified personnel and the necessary construction and maintenance became increasingly more difficult to perform. By utilizing untrained personnel, the overseas Seabee units were held together, but the obvious need to rebuild a skilled, well-trained organization was readily apparent.

Post-war Status

After surveying the available stations for training Seabee personnel for the post-war organization, the U.S. Naval Training and Distribution Center at Port Hueneme, California was selected to perform the training functions for construction personnel. This station had been an Advanced Base Receiving Barracks and had been utilized to furnish space and facilities for newly formed units to orient themselves preparatory to sailing overseas. The base consisted of wooden fifty-man barracks and quonset huts and had little to offer as a location for technical schools beyond space. In accordance with the requirements of the wartime units, activity at this base had been limited to military subjects such as rifle and other weapons marksmanship, extended order drills, scouting and patrolling and similar techniques.[1]

On 12 November 1945, the first post-war technical training classes were convened and were eight weeks in duration.[2] The mission of the station was "to assume the functions of training and handling Seabee personnel within the continental limits of the U.S.A. Courses in demolition, carpentry, refrigeration, gasoline and diesel engine repair, electricity, plumbing, pipefitting, welding, equip-

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1. *Ibid.*, p. 11.

2. *Ibid.*, p. 11.

ment operation, stevedoring, rigging, drafting and surveying were included in this initial program.

It was evident from the start that the eight weeks allotted to training was totally inadequate to furnish graduates experienced enough to cope with maintenance and construction problems existing at overseas stations.[1] The time spent in training was gradually increased to three months without adequately solving this problem, but the need for Seabees at advanced bases was too great to allow for a longer period of training.

As mentioned above, this station consisted of wooden barracks and quonset huts. All classrooms, laboratories, shops and storage spaces were constructed in the quonset huts. Both the small 50'x100' and the large 100'x 200' huts were available and it was possible to set up adequate and rather spacious training quarters. Space was never a problem as Hueneme was originally capable of housing between fifteen and twenty thousand men. The peak training load never reached fifteen hundred. As the personnel on board contracted, first the wooden barracks and then the excess quonset huts were dismantled and removed from the station. This made much more available space for training and since the climate was suitable for outdoor work, much of the carpentry, electrical and equipment op-

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[1] *Ibid.*, p. 11.

eration instruction was carried on in the open air.

Equipment and spare parts were easily obtainable in the early days. With the war newly won, equipment from decommissioned units was piled high on every atoll in the Pacific and it took little doing to see that Hueneme's schools were outfitted with first-rate equipment far beyond that usually found in most vocational and trade schools. However, this situation could not last and now budgetary limitations offer stubborn problems in the task of keeping the equipment operating, to say nothing of the problem of replacement.

As demobilization progressed, it became more and more difficult to keep the schools manned with adequate and qualified instructor personnel. Experience and skill became a rarity in the organization, which now consisted of eighteen year olds and a sprinkling of general service personnel who had transferred to the Seabees for various personal reasons. The Training Center reached the point where they were forced to employ civilian instructors to bridge the gap in the training program. Most of these instructors were former Seabees who upon demobilization continued to instruct in a civilian capacity.

As with most training programs, the principle problem turned out to be the selection of instructors. In addition to the usual problems of finding men who could teach and at the same time be cognizant of the skill which he was

instructing, there was added a problem that is peculiarly attached to service programs using civilian personnel. This was the problem of naval-civilian relations. Much energy was expended before, by empirical methods, a group of instructors were retained who had the knack of getting along with servicemen. This solution was made easier by the successive reductions in the training load which allowed Hueneme to eliminate the less successful instructors without undue difficulty with the Civil Service Commission. It may be well to note that no definite policy has been established in regards to the position of the civilian teachers. Some of them are in charge of the instruction in a particular field, in other Naval personnel oversee the work of civilians. This harmony was assisted by the introduction of instructor training courses which did much to level off the quality of training and to bring about common understanding in reference to teaching and curricula problems.

Rates and Courses

In April, 1947, the Navy initiated the present post-war rating structure. The aim of this move was to condense the unwieldly multitude of specialists into which the Navy had grown into a workable organization of well-rounded artisans. This revision resulted in another name for Hueneme, it now being designated as the U.S. Naval Schools, Construction. The curricula was revised and re-

designed to conform to the new rating structure and in August, 1947, offered training in the seven construction ratings and in the rating of draftsman, which is closely related to the construction field. By this revision, nineteen courses of instruction were condensed into eight schools, each school offering instruction on a primary and on an advanced level. Table 1 indicates the new ratings and their scope.

From the duties listed in Table 1 it is readily seen that a first class rating is a skilled artisan in every sense of the word. The Navy completely reversed its wartime trend towards specialization and now demands a fully rounded craftsman. With the initiation of these courses, the training period was extended to four months and the mission of the station was revised "to instruct enlisted men in each basic rating with the basic instruction required to provide the qualifications as set forth in the Bureau of Naval Personnel "Manual of Qualifications for Advancement in Rating."[1] This mission indicated that the purpose of the Class A or primary schools was to qualify personnel for the rating of third-class petty officer and for the Class B or advanced schools to qualify men for advancement to the rating of first-class petty officer. The Bureau of Yards and Docks and the Bureau of Naval Personnel are both cognizant that only by supplementing this

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[1] Minasian and Ward, Op. cit., p. 12.

TABLE 1.

DUTIES OF CONSTRUCTION RATINGS[1]

RATE	DUTIES
Surveyor	Surveyors make reconnaissance, preliminary, and final location surveys for roads, airfields, pipe lines, ditches, building, drainage structures, and waterfront construction. Operate, adjust, clean and maintain transits, levels, alidades and other equipment. Make hydrographic, topographic, and triangulation surveys, maps, and profiles. Compute cuts and fills.
Construction Electrician's Mate	Construction electrician's mates install, operate, maintain and repair electrical generating equipment, distribution systems (primary and secondary), transformers, switchboards, distribution panels, motors, inside wiring in buildings, and lighting fixtures. Erect poles, attach insulators, string wires and lay cable for high tension power lines and communication lines. Maintain and repair all types of electrical equipment found at advanced bases. Install, operate, maintain and repair communication equipment, PBX exchanges, switchboards, telephones, public address systems, inter-office communication systems, fire alarm systems and portable radio equipment found at advanced bases.
Construction Drivers	Drivers check, operate, maintain, lubricate and repair automotive and heavy construction equipment (trucks, tractors, tournapulls, bulldozers, shovels, cranes, carryalls, pile drivers, ditchers, rollers, graders and other power driven and hoisting equipment used in advanced base construction). Rig cable assemblies and change attachments for special equipment. Follow engineer's directions in excavation and construction operations.
Construction Mechanics	Mechanics check, test, maintain, lubricate, repair and overhaul automotive and heavy construction equipment (trucks, tractors,

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1. Qualifications for Advancement in Rating, U.S. Bureau of Naval Personnel, 1947.

	tournapulls, bulldozers, shovels, crane, ditchers, rollers, graders, hoisting engines, and other power-driven equipment used in advanced base construction). Analyze and diagnose faulty conditions and make adjustments to insure efficient operations. Work on both Diesel and gasoline internal combustion engines. Operate special garage equipment.
Builders	Builders construct, erect, maintain and repair frame, timber and concrete structures such as warehouses, hospitals, barracks, bridges, trestles, tanks, buildings, wharves, and cofferdams. Perform such auxiliary operations as shoring, underpinning, pile jettying, capping, driving and cribbing. Operate sawmills and cabinet and carpenter shops. Build concrete forms, place reinforcing steel, batch, mix and place concrete in all types of structures, including underwater installations. Direct logging operations.
Steel-workers	Steelworkers rig and erect "A" frames, gin poles, derricks, hoists, booms and special tackle to move or hoist heavy equipment, structural shapes and materials. Splice ropes and steel cables; fabricate nets and pontoons. Place, fit, weld, cut, bolt and rivet steel shapes, plates and built-up sections in the construction of advanced base facilities. May rig cable assemblies used in heavy construction equipment, such as shovels, bulldozers, carryalls and cranes.
Utilities Men	Utilities men install, operate, maintain and repair high-pressure and low-pressure boilers, evaporators and equipment for distillation and purification of water, including double effect stills and vapor compression stills, sand filters, puro-pumpers, and pumps. Maintain and repair furnace brickwork, fuel pumps, condensers, evaporators, feed water heaters, injectors and engines. Perform plumbing and pipefitting work required in the maintenance of the above equipment. Make chemical tests to determine safeness and potability of water. Maintain and operate water supply and sewage disposal plants or installations. Operate, service and maintain stationary prime movers used to operate public utilities.

instruction by experience gained on the job in the field can the Navy hope to acquire construction ratings who are fully qualified to perform all the tasks required of such personnel under field conditions.

The courses instituted were under revision at all times in an attempt to keep them up to date and abreast of the needs of the field. Visual aids, teacher improvement, and the philosophy of the means of accomplishing the aims of the station were under evaluation regularly. The lack of professional guidance in the establishment of the curricula and especially in the philosophy of instructing retarded the program to quite an extent. However, by the process of evolution, the current courses are deemed to be an excellent coverage of the subject matter included in the ratings for which the schools are preparing their graduates.

Personnel Selected for Schools

The famous "can-do" spirit of the wartime Construction Battalions was due almost entirely to the high quality of the personnel who volunteered for duty in the Seabees. Like many other conditions, this trend completely reversed itself and only the elan and organization of the Battalions enabled them to carry on their assigned tasks when the war was over and only the young, immature, lads were recruited for enlistment in any of the services.

When the training program was initiated at Hueneme, the principle source of students was directly from the recruit training centers located at San Diego, Great Lakes, and Bainbridge. Although the selection of these recruits was based on the General Classification Test, the press of time and the general lack of supervision and administration present because of the disruptive effects of demobillization, caused the selection process to have serious and often fatal defects. The results frequently were that Hueneme received candidates that were wholly unsuited for construction training and furthermore totally uninterested in receiving it. Perhaps another reason for this lack of interest lay in the general unrest, indecision, and short enlistments that was typical of the service at that time.

As the situation gradually stabilized, the selection of personnel for construction gradually improved. The average score on the GCT test rose from something in the neighborhood of 42 to above 50. This rise coincided with the general increase in education achieved by the recruits. At present the recruits received by Hueneme are excellent material for training, all have been selected as interested in the field, and with an education of at least 11 grade level.

The recruits are selected at the two remaining training centers at San Diego and Great Lakes and use is made of the GCT and other pencil and paper tests, such as

arthimetic, material knowledge and mechanical knowledge. Recruits are selected for the specific school and all that is required at Hueneme is a cursory screening to insure that there are no glaring misassignments. At present writing, the personnel situation in the Construction Units overseas is such that the recruit imput to Hueneme's schools has been discontinued until such time as the field situation requires the imput of additional personnel.

In addition to recruits, Hueneme receives men from several other sources. Personnel returning from overseas for leave and reassignment are directed to Hueneme for refresher and advanced instruction, providing sufficient potential service remains to make that training worthwhile. The Chief of Naval Personnel also sends men to Hueneme who are transferred from the Atlantic to the Pacific area and men who are being transferred from shore to overseas duty for refresher and advanced training. Small numbers of Marines are also trained as the need for the instruction appears.

Although the Class A schools are directed towards preparing the seaman for third class petty officer, a great many of the men who return from overseas are put into these classes as a method of refreshing them for the work of their choice. In the same manner the Class B schools instruct many first class and chief petty officers so that they may be always aware of the techniques and current in-

formation concerning their skills.

Training Philosophy

The philosophy of training in current practice at Hueneme is the result of many revisions and modifications and the result is quite different from the philosophy in use in civilian institutions. Ricciardi and Kibby have suggested ten points to be stressed in teaching in the industrial field.[1] These points are included here in order to compare Hueneme's practices and attempt to draw criticisms that will prove valuable in improving the courses now being taught.

1. Instruction, in order to be effective with vocational students must be given to selected groups. The instruction at Hueneme follows this rule to a greater degree than is common in most schools. The selection program described above insures that only those candidates whose talents are along the industrial skills.

2. The subject matter to be taught must be such as directly functions in the work for which the pupil is being trained. All attempts are made to include only that subject matter that directly applies to the skill being taught, and the result is a course that

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[1] Nicholas Ricciardi and Ira W. Kibby, *Readings in Vocational Education*, New York: The Century Co., 1932, p. 452.

is tailored to meet the requirements of the rate for which the student is being groomed.

3. Instructors must have been occupationally trained in the trade or occupation which they are to teach. Since all instructors employed at Hueneme are required to meet trade specifications, this rule is fully followed.

4. Individual instruction should be given wherever necessary to the progress of any member of the group. Like most schools this is the point that receives less attention than it deserves. The press of time, the student load on each instructor, and the wide spread of ability within the class precludes individual attention to members of the class. Hueneme does recognize this problem and has attempted to alleviate it by teaching the classes in groups. In selecting each group an attempt is made to class the students by ability and thus the instructor can pace his instruction so that the speed of learning is suitable to the big majority of the group.

5. Each individual member of the group should be permitted to progress as rapidly as his ability will permit, and promotions should be made at any time on the basis of ability to do the work required. This tenet is similar to the one listed above and the same

problems are present in this situation. Some attempt is made to change the groups around so that members well versed in one phase are not held back by those not so adequately prepared. Subjects already proficient are not required to be retaken just to keep to a set schedule.

6. Effective training for work can best be given on a real job. The obvious difficulties that arise when an attempt is made to use real jobs as a method of training are all present in the service programs. The cost involved and the materials required preclude very extensive use of this manner of training. Difficulty with labor unions prevent the use of Seabees in strictly maintenance jobs and it is difficult to work jobs of this type into a training program. One real job undertaken by trainees was the erection of a two story building and the results were very satisfactory.

7. All subject matter and training should be arranged in the most effective instructional order of difficulty from the standpoint of acquisition by the learner. Hueneme has evaluated their courses with this thought in mind and the program as it now stands incorporates this tenet to good advantage.

8. The learner should be surrounded by an occupational atmosphere and environment. No special, or unusual effort is made to obtain an environment of this

type but the service atmosphere is of course present and whether for good or evil exerts its influence on the training and it is the same environment as that will be experienced by graduates upon reaching the field.

9. Instruction and training should be based upon prevailing occupational standards. Hueneme rates high on this point. Yet, as with most schools, further contact with new developments, especially those devised in the field would make the program even better in this point.

10. Repetitive training should be sufficient to enable the learner to begin work as an economic asset. Although the time allowed for training is strictly regulated, the graduates sent out to the field have proven to be valuable to the units engaged in maintenance and construction.

It appears that Hueneme has the same problems as most institutions offering trade and industrial training, that of obtaining sufficient motivation, atmosphere, and individual instruction. The problem of obtaining sufficient transfer of learning from an unnatural artificial atmosphere as typified by a classroom has long stumped educational leaders. Hueneme has attempted to solve the problem by extensive use of shops, field problems and intensive indoctrination. Some success has been obtained from these

procedures, especially in the Drivers School where the operation of construction equipment acts as a big boost to the motivation of students. Little success has been obtained with innovations to increase the workaday atmosphere in the schools.

Since the primary schools at Hueneme are Class A schools, the primary mission of these schools is to prepare the graduate for successful completion of the examination for promotion to third class. No attempt has been made to examine the rating structure to see if the rating structure follows civilian standards or fields conditions. It is taken for granted that adequate analysis was made of the duties required of each construction rating and that the rating structure reflects the requirements of each rating in the field.

An attempt is made to include any skill or duty that is required or of value to units in the field that is not inconsistent with the primary mission of the school. Questionnaires are circulated periodically among the overseas units to determine what additional information can be included in the curricula that will prove valuable.

All efforts are made to keep Hueneme abreast of current instructional procedures, equipment, and advancements in occupational procedures. The establishment of the Civil Engineering Laboratory at Port Hueneme will assist in keeping the schools aware of modern technical improvements.

Liaison with educational institutions should be established to keep school equipment and teaching procedures at the peak of efficiency.

CHAPTER III

APPRENTICESHIP

Introduction

Historically, the most important highway travelled in the preparation for entrance into the industrial employment field has been that of apprenticeship. The institution of apprenticeship, in one form or another has been traced back into antiquity to the time of Hammurabi who was king of Babylon around 2250 B.C.[1] Other scholars have noted the reference to apprenticeship made by Plato in his dialogues on wealth, poverty and virtue.[2] However, the system did not really flourish until medeival times when the rise of the master artisan and the Guilds formulated customs and procedures into a code by which young men were taught the secrets of the trade.

The decay of the Guilds, the confusing of apprenticeship with the indenture servant system, and the evils of child labor caused the whole apprenticeship system to fall into disrepute.[3] The industrial revolution, with its de-

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1. The Code of Hammurabi, translated by Robert Francis Harper, (2nd ed.; Chicago: University of Chicago Press, 1904, p. 71.

2. The Republic of Plato, translated by Benjamin Jowett, Oxford, England: Clarendon Press, 1871, Vol. I, Book 4, p. 421 D.

3. Op. cit., Ross.

preciation of the skilled and its need for cheap labor, put the finishing touches on the system and it remained dormant for many decades.

The rise of modern industry, mass production, and the activity induced by the first world war taxed the American labor market severely. An attempt was made by the industrialists to lessen the strain by increased immigration of skilled artisans from Europe.[1] The shutting off of this source of labor by the legal restrictions imposed by Congress after the first World War revived interest in the apprenticeship system. Early Unionism however, was bitterly opposed to the idea and a long bitter battle was fought with manufacturers' associations on this issue. Union and management gradually ironed out their differences and developed the program now in effect. The National Industrial Recovery Act of 1934 first recognized the value of this institution and set up the first national regulation procedure.

The triumph of labor unionism in the thirties resulted in a new lease of life for apprenticeship. The unions became strong enough to demand and receive a voice in the formation and administration of the program. The degree to which a union can control the apprenticeship system for that craft depends to a large extent upon the strength of that union.

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[1] *Op. cit.*, Moss.

Definition and Standards of Apprenticeship

Perhaps the most complete definition of an apprentice is that of the United States Employment Service:[1]

> Apprentice: - Although often loosely used, this title is intended to mean a worker not less than sixteen years of age engaged under direct journeyman supervision, and according to a prescribed or traditional series of work processes graded to coincide with increasing trade materially in learning a skilled occupation that requires during the learning process, several years of reasonably continuous employment prior to the time that the worker may be considered a qualified journeyman. In general, apprenticeship is legally recognized only if recorded in a written contract, indenture, or agreement, in which, in return for services, the employer promises to teach the worker the processes of his trade. The terms of an apprenticeship agreement usually includes specific references to the duration of the apprenticeship period, a progressive scale of wages, and the nature of the processes to be taught. Frequently the agreement also specifies the amount and nature of related schooling in vocational subjects in which the worker shall engage during his apprenticeship period.

National standards for the apprenticeship program were set up by the Federal Committee on Apprenticeship which was initiated by the Fitzgerald Act of 1937.[2] This committee proposed the following basic standards:

1. An apprenticeable occupation is considered to be one that requires 4,000 or more hours to learn.

2. The terms and conditions of employment and training should be included in the indenture which should be signed and filed with the State Apprentice Council.

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[1] Dictionary of Occupational Titles, Part I, U.S. Department of Labor, 1939. U.S.E.S. U.S. Dept. of Labor, Washington: Gov't Printing Office.

[2] U.S. Statutes at Large (1937), 664; 29 USC 50.

3. Work processes to be learned on the job should be listed and scheduled.

4. The wages should average at least half of the journeyman's wage over the four year apprentice period.

5. A minimum of 144 hours of related instruction should be provided for.

6. Upon completion of his term, an apprentice should be given a certificate showing completion of the work.

An Appraisal of the System

The future of apprenticeship can not be predicted with any degree of accuracy at this time. The popularity of the system dates back only to 1937,[1] and since that time the country has been engaged in a major war with its attendant boom periods both before and after. What would happen should this country encounter a depression is problematical. Yet, a few generalizations can be made as to the present condition of the program and the views of management and labor can be determined.

First of the advantages of this system is the cooperation of labor and management. The results obtainable from this combination are what made America a leader in the world today. Secondly, labor and management are assisted in an advisory capacity by a committee of impartial experts.

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[1] Op. cit., Niemole.

There is every indication that this committee is extremely able and interested in the apprentice program.[1] Next, specific standards have been deliniated. Lastly, all other known substitutes have been tried without any large degree of success.

As for testimonials as to the efficacy of the apprentice program there are countless statements by representatives of both labor and management testifying to this effect. Warner and Swasey of Cleveland, Ohio, one of the largest machine tool manufacturing companies in the United States offers the following justification:[2]

> Even when trained mechanics go into lines of work where no apprentice shops are maintained, as for example, when men trained in machine tool shops go into automobile plants, their training is not altogether lost to the machine tool industry. The highly developed state of the automobile plants, for example, is largely due to the training that many of the leaders in this field have had in machine tool shops and because of this training, they have been able to place the automobile industry on a productive plane, so that it has become one of the most important purchasers of machine tool equipment. Whatever promotes mechanical ability in any line, promotes the interests of the machine building industries as a whole.

Representatives of the Chevrolet Company have this to say:

> Chevrolet figures that its apprentice shop pays its own way. That is, at apprentice wages and under

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1. *Op. cit.*, Siemels.

2. Warner and Swasey, *A Modernized Apprentice System*, pp. 415-416, quoted in Arthur B. Mays *The Problem of Industrial Education*, p. 230, New York: The Century Co. 1927.

3. "Training on Modern Machines," *American Machinist* [illegible] (April 22, 1936), pp. 338-40.

> proper supervision, the boys can produce full value for the actual cash outlay made in operating the shop. There are other advantages, however, apart from the dollar-and-cents measure of the shop's worth. The company feels that after four years of training at good wages and under favorable working conditions, boys will have a solid groundwork on which to develop their special abilities. From their ranks should come the future shop executives. Their loyalty and understanding of their jobs will be worth many times the temporary allegiances of fly-by-night workers who shift constantly from one industry to another and from one company to another in the same industry.

Labor's viewpoint is characterized by this statement:[1]

> The International Brotherhood of Electrical Workers is committed to the policy of proper training and education of its apprentices; this by unanimous action of many of our international conventions, following the recommendations of its chief executives, that our individual members and locals should encourage and participate in any movement which has for its object the fulfillment of this policy.
>
> We believe that proper provisions should be made to permit apprentices to utilize what talent they possess in order to advance themselves to the higher positions. Their ambition should be encouraged and the road should be made straight for them so that by proper training they could occupy any position in the industry in their particular field.

The apprentice system, at present, trains only a very small percentage of the whole labor force. The ratio of the number of skilled craftsmen required to the number of apprentices in training is very low. A study by Horridge[2]

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1. Edward J. Evans, Pioneering in Apprentice Training, American Federationist XXXII, Aug. 1924, p. 696.

2. Frederick Horridge, The Problem of Apprenticeship in the Six Basic Building Trades, Trade and Industrial Series, No. 5, Division of Vocational Education, University of California, Berkeley: Sept. 1928, p. 14.

concluded that an apprentice-journeyman ratio of 1:7.3 was the appropriate ratio required to assure a continuing supply of trained craftsmen adequate to meet the needs of industry. The apprentice-journeyman ratio in the United States in 1940 is shown in Table 2.[1]

TABLE 2.

APPRENTICE-JOURNEYMAN RATIO - U.S., 1940

Trade	Apprentices	Journeymen	Ratio
Carpenters	7,425	766,213	1:103
Electricians	3,420	227,102	1: 66
Machinists	14,198	521,093	1: 37
Plumbers	5,211	210,815	1:140
Printers	10,020	240,881	1: 24

However, the apprentice programs are showing a continuing, rapid increase. In the year from September, 1945 to September, 1946 the increase in apprentices in the United States jumped from 25,800 to 68,200, a 14% gain. In the year from September, 1946 to September, 1947 the increase was 17%.[2]

It is of interest to note that America's leading apprentice in the electrical industry for 1948 was a 32 year-old veteran Seabee named Robert W. Hutchison who was employed by the Althoff-Howard Electric Company of Evansville, Indiana.[3] Hutchison served in England and Scotland

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[1] Alfred Kohler and Ernest Hamberger, Education for an Industrial Age, Oxford: Cornell Un. Press, 1948, p. 183.

[2] Siemle, Op. cit., p. 92.

[3] Labor Information Bulletin, U.S. Dept. of Labor, Jan. 1949, p. 17.

for over two years and had varied experiences in electrical construction and maintenance work. While with the Seabees, he invented a magnetic road sweeper to pick up nails and other metal objects around the construction jobs at the base where he worked - a machine which he disclaims as an achievement, insisting that it was merely a simple application of an elementary principle.

In March 1946, a few months after discharge from the Navy, he applied for a job as an apprentice in Evansville under the city-wide apprenticeship program in the electrical industry. When accepted by the area joint apprenticeship committee, he was given credit for his previous experience which enabled him to complete his training in a little more than two years, instead of the regular four years required of beginners.

Dancher made a study of the essential features of apprentice ship practice in the United States and concluded among other things that apprentice work experience should be carefully supervised according to a predetermined schedule of work processes, co-ordinated with school instruction and with the work available in the shop and adjusted fairly and expeditiously to emergency conditions. Related school instruction should be provided in subjects designed to increase the apprentice's technical and practical understanding of the tools, materials, processes and economics of his trade. This education, properly co-ordinated with work ex-

periences, should be provided by teachers capable of stimulating successful instruction. Provision should be made in the apprenticeship program to adjust the variety of work experience and related supplementary school instruction to the ability and performance of the individual apprentice. Objective records should be maintained of each apprentice's status and progress in manipulative skills and technical knowledge.[1]

Danaher found that apprenticeship was firmly entrenched as the principle system of training skilled craftsmen but that the great mass of industrial workers is only of the semi-skilled classification and that present training methods teach the worker only certain phases of the trades and make no attempt to evolve a well rounded mechanic.[2] Danaher pointed out the difference between "upgrading" and apprenticeship which is often confused. Upgrading is the training of specialists in one or two processes in other related processes in order to obviate production bottlenecks and to make the labor force more flexible.

Advancing the worker is training for a limited list of related job classifications rather then the unlimited jobs that go to make up a trade.[3] The problem of training

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[1] Eugene Ives Danaher, *Apprentice Practice in the United States*, Stanford University Business Research Series 23. Stanford, California: 1946.

[2] Danaher, *Op. cit.*

[3] Danaher, *Op. cit.*

Seabees is one of teaching a full trade. No abridgement of the processes, which is so typical of modern industrial training, is possible. The Construction ratings must be able to perform creditable in all phases of their trade. The average Seabee is constantly improving his training, education, and technical knowledge more than his counterpart, the journeyman or master craftsman. The type of construction and maintenance that is performed by construction Battalion units overseas is such that requires up-to-date information.and skills.

Apprenticeship has been nurtured through the period of greatest expansion by the larger and more firmly established concerns. The U.S. Navy has played an important part in the institution of apprenticeship by maintaining the system in the various Navy yards throughout the country.[1] Moss conducted a study of the apprenticeship program in the Philadelphia Naval Shipyard and found that the procedures there although in need of revision and out of date in many details, was by far superior to any type of instruction that failed to teach a full trade.[2] Moss suggested further use of a series of planned projects supplemented with related instruction in the classroom to teach the apprentice his trade. The use of projects under production conditions

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[1] Moss, Op. cit.

[2] Moss, Op. cit.

and under competent supervision would provide the atmosphere and motivation usually lacking in most types of training. A planned series of projects would insure the coverage of the trade without gaps which has proved to be the fallacy of apprenticeship programs in industry that are dependent upon the usual run of the work to train the apprentice and often places the processes in incorrect order or omit important phases entirely. The operations and works load of most shipyards are ideally suited to training a well-rounded artisan since the yards cover practically all phases of the trades and the work load is planned far enough ahead so that a planned project curriculum can be carried out. Moss places much emphasis upon mathematics, English, including report and letter writing, drawing, and lectures on subjects connected with the trade with a view of broadening the general knowledge and preparing for good citizenship of the apprentice.[1]

Although the value of Moss' conclusions are indisputable, there is little that Hueneme can incorporate into their curricula to improve their training. It appears that a study to consider the possibility of preparing schedules of processes to be learned by Hueneme graduates when they are received by units overseas would prove valuable. Since the principle task of these units is maintenance rather than new construction,

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[1] Moss, *Op*. *cit*., p. 71.

it may be possible to schedule a pattern of work processes that will provide complete coverage of the field in which the Seabee has been trained.

LaTrobe, Keyes, and Kirk conducted an interesting study of apprenticeship in the electrical and plumbing trades in New Zealand.[1] It was found that employers felt that the related instruction had as its primary function the job of teaching the elementary knowledge of principles of the trade. Both labor and employers were against the substitution of trade schools for apprenticeship. Keyes found that the electrical apprenticeship fell far short of ideal, especially in furnishing the apprentice with a program of processes that covered the entire field of electricity.[2] Kirk, on the other hand, found that the plumbing trade had devised a program that gave complete coverage of the trade plus an adequate related instruction of good quality.[3] The study concluded that a four or five year apprenticeship was required to produce a good craftsman and that better planning and administration was required to maintain the flow of trained mechanics into industry. Governmental help was recommended, especially in the electrical

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1. W. W. LaTrobe, C. E. W. Keys, A. A. Kirk, Studies in Apprenticeship, New Zealand Council for Ed. Research, 1939.

2. Ibid., p. 50-51.

3. Ibid., p. 62.

trade where specialization of small employers prevented apprentices from receiving a rounded training.[1]

Current Policies

The rise of the labor unions, the advent of World War II, the shutting off of immigration from Europe, and the entry of the government into labor problems have combined to alter the institution of apprenticeship. The Apprentice Training Service has been set up to supervise and offer suggestions on the program to train skilled artisans for industry. States have organized State Apprenticeship Agencies to act in an advisory capacity and to assist labor and employers to organize and maintain a workable program. The Construction Industry, in 1938 was the first to establish a National Joint Trade Apprenticeship Committee to coordinate programs in various parts of the country. State and local joint committees are formed by many trades to carry out policies of the National committees. The Federal Committee on Apprenticeship deprecated any appreciable shortening of the time required to train apprentices to become skilled mechanics and this view is prevalent throughout industry.[2]

Not all trades are apprenticable, and as mentioned previously a trade must require 4000 hours or more to learn.

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1. Ibid., p. 53.

2. Niemela, Op. cit.

Table 3 is a list of apprenticeable occupations that are related to the skills taught at Hueneme. In addition to the scheduled processes that are considered to make up the trade, each apprentice is required to attend formal instruction classes, either made available by public institutions, the labor union, or the concern by whom the apprentice is employed. This instruction must be at least 144 hours per year and is required for all years of the apprenticeship. More and more attention is being given to this part of the program and the Bureau of Trade and Industrial Education, Department of Education of the State of California has taken the lead in formulating a workable course of study for each apprenticeable trade.

This Bureau of Trade and Industrial Education has developed texts, tests, and examinations for the use of the instructor in these schools and have it so arranged that one instructor can teach apprentices of varying grades and can let each one progress at his own pace. No attempt is made to teach the trade or the mechanics of the operations at these sessions, but the emphasis is in instructing in the background materials like mathematics, theory of the trade, business procedures, and general trade information.

California is a leading example of the progress that can be obtained when all interested parties cooperate in formulating a plan whereby adequate instruction is given to the new members of the labor force. The Apprenticeship

TABLE 3.

LIST OF APPRENTICEABLE TRADES WITH TERMS OF APPRENTICESHIP THAT ARE SIMILAR TO SKILLS TAUGHT AT [illegible][1]

Trade	Term	Trade	Term
Automotive Mechanic	3-4	Mechanic, Maintenance	3-4
Blacksmith	4	Millwright	4
Boatbuilder (small)	4	Motor Repairman, electric	3-4
Boilermaker	4	Operating & Stationary engineer	2-4
Brickmason - Bricklayer	3	Painter	3
Cabinetmaker	4	Pipefitter	4-5
Carpenter	4	Plasterer	3
Carpenter, ship	4	Plumber	4-5
Cement Finisher	2	Radio Repairman & Service Mechanic	2-3
Coppersmith	4	Refrigerator Mechanic	3-4
Draftsman	3	Rigger	2-3
Electrician	4-5	Sheet Metal Worker	4
Aircraft		Aircraft	
Construction		Automotive	
Industrial		Construction	
Maintenance		Industrial	
Lineman		Shipfitter	4
Iron Worker, structural	2	Shipwright	4
Joiner	4	Shipyard Rigger	2-3
Linoleum, carpet & soft tile layer	3-4	Steamfitter	4-5
Machinist	4	Stonemason	3
Aircraft		Tile Layer	3
Automotive			
Marine			
Railroad			
Shipyard			

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1. U.S. Office of Education, Vocational Division Bulletin #228, Vocational, Technical Training for Industrial Occupations, Washington, D.C.: Govt. Printing Office, 1946.

Law of California is not a regulatory body, but rather an advisory one, since the program is one of cooperation rather than of force. The California Apprentice Council, also known as the Division of Apprenticeship Standards of the State Department of Industrial Relations has the authority to investigate, approve or reject applications from establishments for apprenticeship and other on-the-job training. Tables 4 through 6 are examples of the schedules of processes that were approved by this agency for the instruction of apprentices. This division works with labor and management and was intrusted by the national government with the certification of training of GI's under the GI Bill of Rights.

Table 7 is an example of the course of study devised by a state vocational educational department which was given by state instructors on the premises of a large manufacturing concern to their machinist apprentices.

Concerns like General Electric, Warner and Swasey, Westinghouse and the United States Aluminum Company have run apprentice programs for years. It has proven beyond question to be the most satisfactory way to implement the labor force. The time and money required to maintain the program has caused many companies to try other methods of teaching, for instance the corporation school, but their lack of success coupled with the technological improvements resulted in the trend towards semi-skilled labor and decreasing the need for highly skilled craftsmen.

TABLE 4.

SCHEDULE OF MAJOR PROCESSES AND APPROXIMATE NUMBER OF HOURS FOR EACH PROCESS UNDER STATE OF CALIFORNIA APPRENTICE AGREEMENT FOR THREE DIVISIONS OF THE ELECTRICAL TRADE

PROCESS	APPROX. HOURS
Electrician - Maintenance	
Dismantling, cleaning & assembly of motors	600
Repairing & maintaining of control equipment	1000
Maintenance & installation of wires in conduit work and overhead lines on poles	1600
Maintenance & inspection of traveling cranes, hoists, etc.	600
Testing, installing & maintaining recording instruments	1000
Installing & maintaining of fluorescent lights, flood, etc.	1000
Switchboards, meters, voltmeters, ammeters, etc.	400
Coil winding, motor windings, bearings on motors	600
Trouble shooting	1000
TOTAL	8000
Electrical Motor Repairman	
Dismantling, stripping & cleaning motor	500
Make cell installations, make coils & prepare for coils	700
Place and connect coils in stator	2200
Varnish and bake	200
Assemble motor and make test	500
Test incoming motors	500
Work on armature	700
Work on D.C. fields	200
Control equipment	1500
Transformers	1000
TOTAL	8000
Electrical Inside Wireman	
Knob and tube	1700
Remodeling residential & commercial structures	1700
Trouble shooting	300
Appliance repair	300
Conduit work	900
Motor installation	300
Electrical automatic controls	300
Stock room	300
Industrial installation	600
Temporary wiring	300
Signal systems	900
Fixture installation and trim	400
TOTAL	8000

TABLE 5.

SCHEDULE OF MAJOR PROCESSES AND APPROXIMATE NUMBER OF HOURS FOR EACH PROCESS UNDER STATE OF CALIFORNIA APPRENTICE AGREEMENT FOR DIESEL MECHANIC

PROCESS	APPROX. HOURS
Parts department, marking, unpacking posting and parts sales	500
Disassembly of engine, cleaning and preparing parts for inspection and assembly	1000-1500
Reconditioning injectors	1000-1500
Reconditioning blower and assembly	1000-1500
Reconditioning governor, hydraulic and mechanical	1000
Reconditioning basic engine assembly, piston, crank shaft rods	2000
Engine tune up and installation of new engines.	1000
TOTAL	8000

TABLE 6.

SCHEDULE OF MAJOR PROCESSES AND APPROXIMATE NUMBER OF HOURS FOR EACH PROCESS UNDER STATE OF CALIFORNIA APPRENTICE AGREEMENT FOR AUTOMOTIVE MECHANIC

PROCESS	APPROX. HOURS
Tool Room	160-180
Brakes	360-540
Tires, Wheels, Springs	360-540
Frames, front and rear axles, steering gears, universal joints	560-740
Clutches, transmissions	360-540
Cooling systems	320-400
Fuel systems, carburetors, pumps, injectors	960-1280
Engine, top and bottom overhauled	1600-1800
Storage batteries	160-200
Starting motors, generators, lights electrical accessories	1200-1500
Welding brazing, soldering	200-300
TOTAL	6320-8000

TABLE 7.

RELATED SUBJECTS CURRICULA CONDUCTED BY THE STATE VOCATIONAL EDUCATIONAL DEPARTMENT FOR MACHINIST APPRENTICES[1]

First Year		Second Year	
Drafting ---------- Use of Instruments & Tracing Sketching of parts with dimensions for shop use Blueprint Reading	100 hours	Drafting ---------- Orthographic Projections Drafting Room Systems Conventional Standards Detailing	100 hours
Shop Talks and English --------- Technical Reading & Discussion Business English Correct expression of ideas	25 hours	Shop Talks and English --------- Preparation of papers on relation of time to output of work Machine values & output Safety methods & appliences	25 hours
Science ---------- Materials Cutting Speeds and Feeds Cutting Tools, Lubrication Compounds	25 hours	Science ---------- Mechanical Movements Gears, Levers, Cams Transmission Tools & Materials	25 hours
Mathematics ------- Fractions & Factoring Decimals Pulley Speeds Belting Screw Threads	50 hours	Mathematics ------- Geometry Angles and Triangles Plain Trigometry Simple Formulaes	50 hours

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1. U.S. Chamber of Commerce, Department of Manufactures, *Apprenticeship*, Washington, D.C.: 1927.

TABLE 7. Continued

Third Year

Drawing ---------- Detail & Assembly Drawings for plant use Methods of revision Jigs & fixtures	100 hours
Shop Talks and English --------- Preparation of papers on service, cooperation, teamwork and advancement	25 hours
Science ----------- Hardening & Tempering Case hardening Ball & Roller Bearings.	25 hours
Mathematics ------- Plane Trigometry	50 hours

Comparison of Apprenticeship with Seabee Program

There are many similarities between apprenticeship and the career of a Seabee. Figure 1 is a graphic comparison of the various grades within a trade with the grades in the Navy. It shows that graduation from apprenticeship corresponds with promotion to PO1c. Journeyman status is comparable to PO1c. Master craftsmen is similar to CPO. Financial returns are also fairly equal. In calculating the pay of Naval personnel, the allowance for subsistence and housing was included for all grades as if the sailor would draw monetary compensation. It is recognized that this procedure would not be possible in practice, but on the other hand these same necessities are supplied in kind in all cases. Table 2 is a comparison of the pay of an apprentice and a Seabee who is promoted promptly as he becomes eligible and assuming vacancies are available.

The majority of apprenticeship programs require four years to complete. As indicated by Figure 1 it takes a construction man at least 40 months to make PO1c which is the comparable rating to journeyman. Since forty months is the minimum and few will be so fortunate as to make PO1c in that length of time, the comparison is very close. In a four year period, the average Seabee will be ordered to Port Hueneme twice, once for the Class A school prior to being ordered overseas and again upon reenlistment or upon being returned to the States for leave and reassignment. Upon

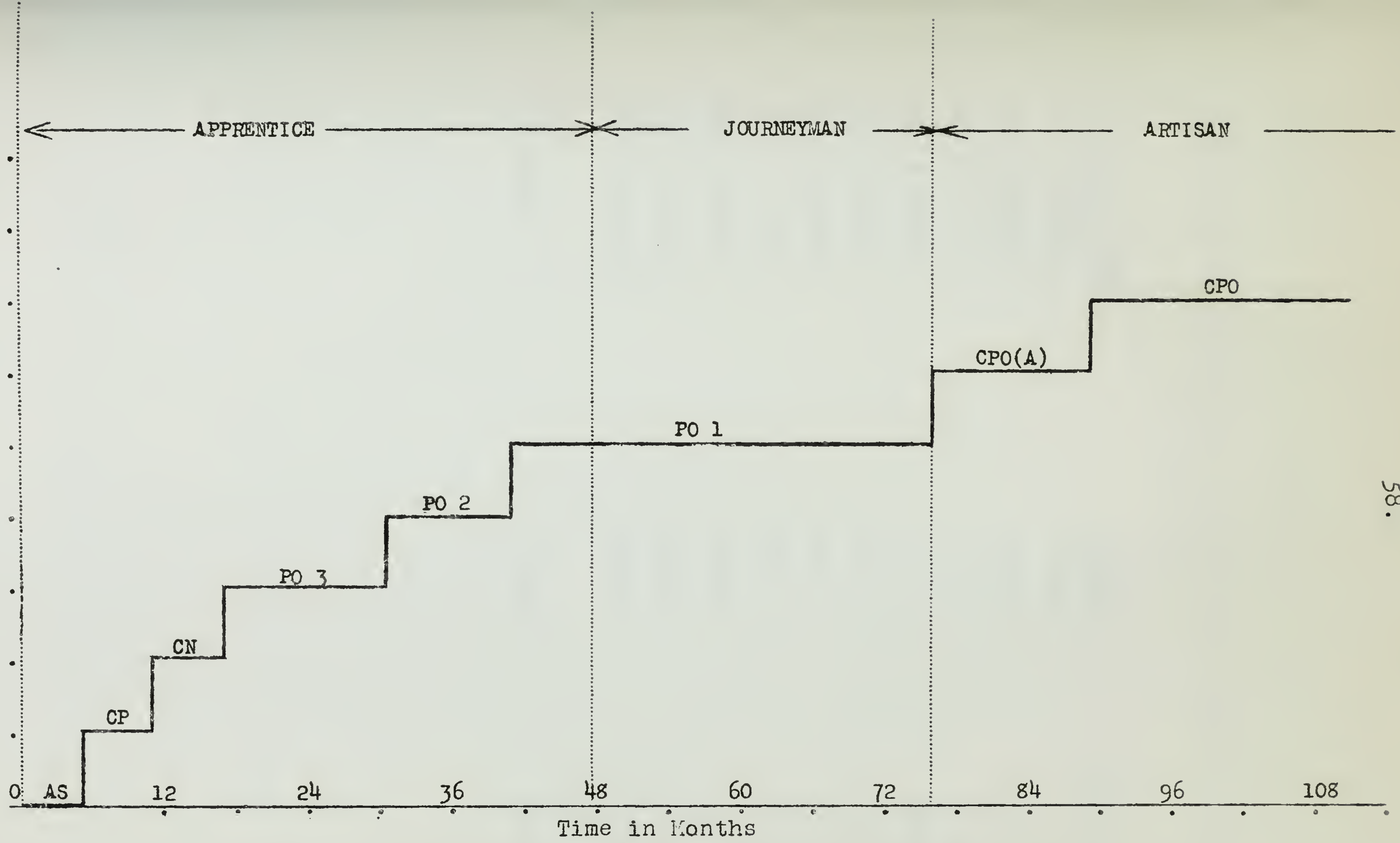
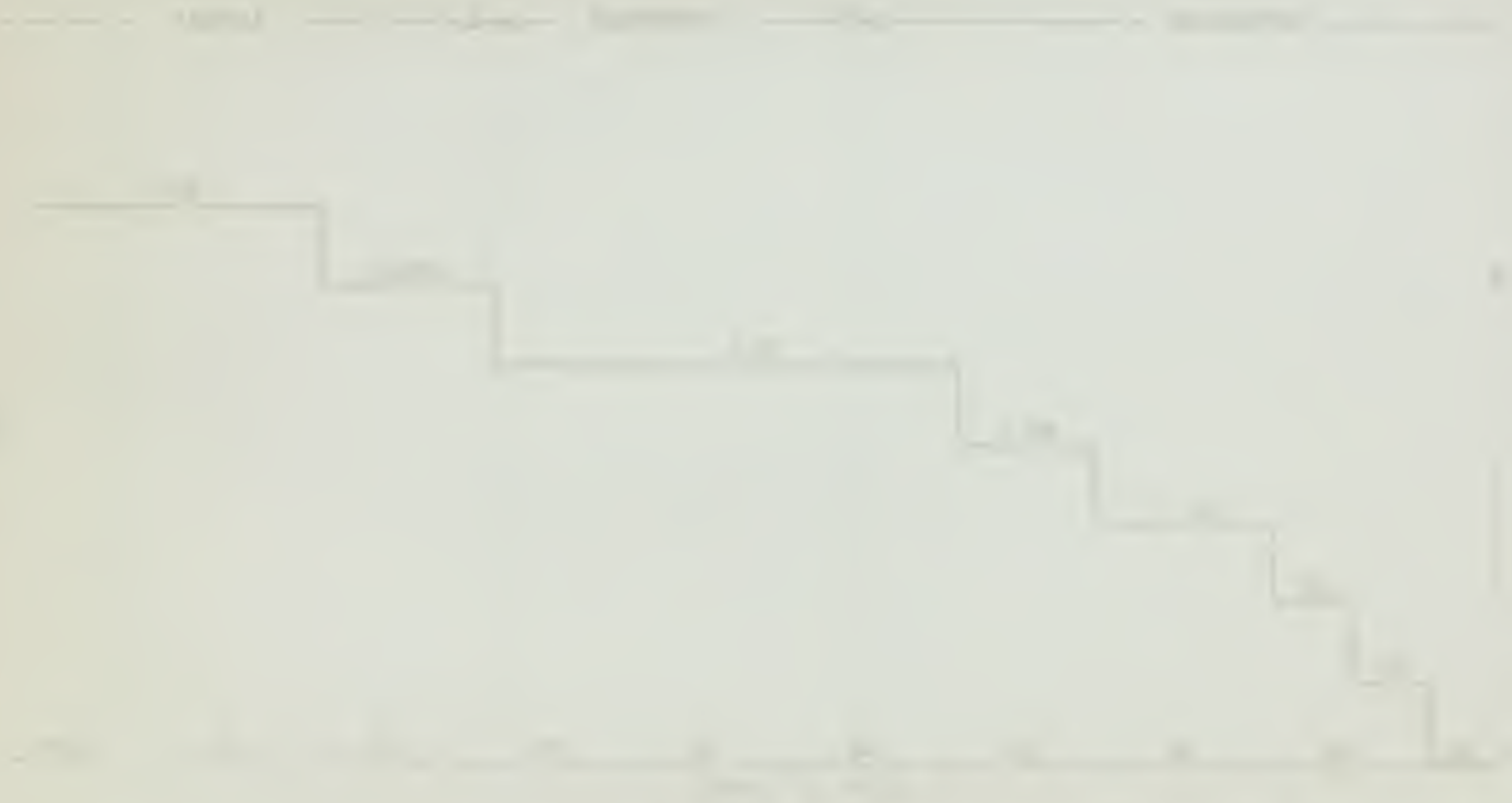


FIGURE 1. COMPARISON OF TIME REQUIRED FOR PROMOTION TO EACH SUCCESSIVE GRADE IN APPRENTICESHIP AND IN THE SEABEES.



[illegible]

TABLE 8.

COMPARISON OF SEABEE PAY WITH THAT OF A CRAFTSMAN THROUGHOUT HIS WORK LIFE

Length of Time	Seabee	Craftsman
1st 3 months	151.50	138.66
2nd 3 months	159.00	156.00
3rd 3 months	159.00	173.33
4th 3 months	172.05	190.66
3rd 6 months	194.10	208.00
4th 6 months	201.45	225.33
5th 6 months	246.00	242.66
6th 6 months	246.00	260.00
7th 6 months	268.05	277.33
8th 6 months	275.40	311.99
		346.66
10 years	326.85	346.66

returning to Port Hueneme, the Seabee enters the Class B school and is prepared for advancement to PO1c or in terms of civilian usage, to the grade of journeyman. Each school consists of approximately 356 hours of instruction, making a total of 712 hours. The apprenticeship program requires related instruction of at least 144 hours per year or a total of 576 hours. It appears that the two courses at Hueneme could be used to prepare the construction man for his duties in the same manner that the related subjects instruction prepares the apprentice for entry into the labor force.

The present philosophy of instruction at Hueneme attempts to train the student in the procedures and mechanics of the trade by creating a work-a-day atmosphere in which the student can learn the knowledge required to perform creditably in the field. In order to accomplish this task with the personnel assigned to the Construction Battalions, it is necessary for Hueneme to begin with much more elementary subjects than do the apprenticeship classes. Time has to be assigned to the practice and methods of doing the job in the field. And finally the Hueneme' course goes farther since all construction ratings include more than one apprenticeable occupation.

It is obvious, of course, that the two tours of instruction at Hueneme can never furnish a finish product comparable to the apprenticeship program unless definite and

complete instruction is carried on in the field. In searching for a solution to the problem of improving the quality of Seabee personnel, it appears that too much attention has been paid to improving Ruenate and far too little in attempting to improving and unifying the instruction given in the field. It is admitted that many of the units overseas are too small to be able to furnish a complete schedule of work processes, but by the use of careful assignment between units within the area, personnel could be afforded the opportunity to learn all the processes of his selected trade. This method is used throughout industry where the shops employing apprentices are too small or too specialized to be able to instruct the apprentice in all phases of the trade. Keyo and Latrobe make mention of the procedure in their study of apprenticeship in New Zealand.[1] The War Department's Committee on Education and Special Training, during the first World War, developed instructional manuals that were designed to teach the trade to the individual by preparing problems to be executed by the student.[2] Complete directions were attached in the form of a job sheet. It appears that investigation of a method of instruction in the field of this nature would prove

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[1] Keyo, Latrobe, Kirk, *Op. cit.*

[2] U.S. War Department, Committee on Education and Special Training, *Surveying*, Govt Printing Office, Washington, D.C.: 1919.

beneficial and that considerable quantity of actual maintenance and repair could be assigned to students to be accomplished as steps in their preparation for advancement. However, it is important that all units have a similar program and that all construction men of each rating learn the same processes and in the same form. A central agency would be required to coordinate the training given in the field. Hueneme's curricula could be reevaluated on the basis of the processes learned in the field and more theory and background would replace the process and procedures now taught.

It is realized that any attempt to set up such a training program in the field would immediately create many problems and would probably hamper the daily work schedule, but expecting an artificial classroom situation to train competent craftsmen is spurious and results in lost time and inferior workmen. Apprentices have a place in industry and they must have a place in the Seabees. The Hueneme graduate must be instructed competently when he reports to the field. The transfer of learning is greatest in the normal work situation where the man can learn by doing and Hueneme's job should be the preparation of the constructionmen for assignment to the field.

Much is written about the new vocational schools and the increasing popularity of terminal courses in junior colleges, but these institutions are not replacing apprenticeship. Rather, they are training a new class of American

worker, the technical assistant.[1] The added time spent in classroom study demands recognition and status. From this demand the technical assistant was born and he is forcing his way into the labor market not at the expense of the master craftsman, but at the expense of the semi-skilled by assuming the lower supervisory and technical staff positions in highly mechanized industries.[2] American industry has proven again and again that there is no substitute for apprenticeship, and if the post-war Seabees are to become the highly skilled craftsmen they were in World War II, then an apprenticeship program must be initiated throughout the Construction Battalions.

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[1] Walter C. Wells, *Op. cit.*

[2] Walter C. Wells, *Op. cit.*

CHAPTER IV.

INDUSTRY'S TRAINING PROGRAMS

Introduction

In surveying the industrial field it soon becomes apparent that construction firms do little if any training except for "on-the-job" informal instruction between journeymen and their helpers. Construction projects, by virtue of their above average wage scales, their promise of overtime bonuses, and the fact that the majority of the work need not be accomplished to narrow tolerances, have been able to recruit workers without elaborate formalized training.

Nevertheless, the men on construction jobs had to be trained somewhere, and in the majority of cases, it has been found that they received instruction in some formal manner. Therefore, this study has surveyed current practices in leading corporations on the assumption that leaders in industry must also be leaders in training.

This is a most auspicious time to survey the field of training in industry. This nation has recently emerged victorious from a world-wide struggle, which victory was made possible because America was successful in meeting its manpower problem through its skill in training.

Danaher completed a thorough study in June, 1946 of the Federal Training Within Industry Program which covered training procedures in all types of industry.[1] However, it must be kept in mind that this study was concerned essentially with training in the war years where speed was of the first importance and specialization was the order of the day. Nevertheless, Danaher's study can be of benefit in relating experiences and in pointing out methods which seem to provide a basis on which to build a sound training program.

There are many types of programs used within industry to promote knowledge. That this imparting of knowledge and skills to new workers is of the utmost importance is attested to by the wide variety of training procedures developed to impart these skills in the shortest time and with the least expense to the industrialist. The age old institution of apprenticeship outlined in Chapter III is firmly established as the most important system by which it is possible to develop highly skilled craftsmen. The length of time required to impart knowledge in this manner and the cooperation of Unions required to maintain this institution has tended to restrict its use. The corporation school was invented by industry in the last decades of the nineteenth century to meet the labor needs that were beginning to be-

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[1] Danaher, *Op. cit.*

come a major problem of all types of industry. The corporation school was instrumental in focusing attention on the problem of vocational and trade training and fulfilled its destiny by the impetus given to the public education of this type. Pre-employment, vestibule, and company schools are all offshoots of this movement.

Types of Training Programs

An example of the wide range of the programs established by different sections of industry to provide the knowledge necessary to carry on operations is given by Danaher in his listing of twenty-two types of programs in effect during World War II. The list is reproduced below to emphasize the value given to formalized instruction by private capital.[1]

1. Cooperative Training:- In-service training in which trainees are paired so as to maintain a job while still attending school. The members of each pair alternate work and school, in such a way that while one is working, the other is attending school.
2. Conversion Training:- Training to enable the worker to shift to a job in the same or different industrial job-family.
3. Foreman Training:- In-service training of foremen to help them to do their jobs more efficiently.
4. Introduction Training:- Orientation of the worker upon hiring.
5. In-Plant Training:- Any form of training given within the physical boundaries of the plant, or involving the use of plant facilities or equipment.

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[1] Danaher, Op. cit.

6. In-Service Training:- Training for persons who during the period of training are employed in essential activities and are in training for employment in the same or another essential activity.

7. Job-Instructor Training:- In-service training to give supervisors practice in methods of training workers.

8. Job-Methods Training:- In-service training to instruct supervisors how to improve current methods of doing the job.

9. Job Relations Training:- In-service training to give supervisors pointers and practices in how to work with people in the manner which gains cooperation and promotes teamwork.

10. Observer Training:- A method of training by which the trainee learns to do a job by alternately watching a competent worker do it and then by doing it himself until able to do it satisfactorily.

11. On the Job Training:- In-service training given employed persons on actual production work.

12. Orientation Training:- Training intended to acquaint persons entering a new job with the conditions surrounding the work; usually includes instruction on working rules and regulations, timekeeping, procedures, safety requirements, and similar information.

13. Pre-Employment Training:- Training for persons who during the period of training are not employed in essential activities.

14. Pre-Production Training:- In-service training given in advance of assignment to a work station.

15. Program Development Training:- In-service instruction for training directors in how to identify training needs and problems and how to plan and operate programs to meet them.

16. Refresher Training:- Training for persons who need training to bring them up to date in an occupation in which they have previous experience.

17. Remedial Training:- In-service training designed to

correct specific difficulties discovered in the performance of a job or operation.

18. *Supervisor Training*:- In-service training of persons in supervisory positions to increase their knowledge of their own work and responsibilities and their skill in instructing planning and leading.

19. *Supplementary Training*:- Intensive in-service training for specific occupations.

20. *Teacher Training*:- Training in methods of teaching and organizing instructional materials.

21. *Vestibule Training*:- In-service training given in a vestibule, bay, or section of a shop physically separate from the production section of the shop, and under the direction of the training supervisor.

22. *Week-About Training*:- Cooperative training in which the periods are of one week duration.

In order to draw comparisons and lessons from the experiences of industry, a brief description of the major training programs will be included at this point.-

Corporation Schools

The corporation school has had an interesting and significant development in American industry and American education. It came in response to a real need, one that was not adequately met by existing agencies. These schools grew up within industry itself and were designed to meet specific needs. Although there are a few schools of this pattern left, their functions have been taken over largely by vocational, trade, and continuation schools working in cooperation with industry.

A corporation school is defined as a school main-

tained by a business concern, quite independent of outside control, for the purpose of fitting its new employees for efficient service, or for the further training of older employees to fit them for positions of greater responsibility as foremen, supervisors, executives, or technical experts. Corporation schools are divided into six types as follows: Special training schools; advertising, selling, and distribution schools; retail salesmanship schools; office work schools; unskilled labor; and trade apprenticeship schools.[1]

Beatty investigated these schools and came to the conclusion that the chief value of these schools lay in their ability to provide incentives and motivation beyond that obtained in ordinary trade and vocational institutions. The curricula and courses of public secondary schools and technical schools show on the whole a better logical and pedagogical organization than those of corporation schools. However, the corporation schools are more superior in that they are more specific and in having a closer relation between the materials employed and the ends sought, and that some show a decided superiority in time allotments.[2]

Since the corporation school has almost entirely been replaced by public vocational and trade schools, examples of the corporation curricula have not been included.

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1. Albert J. Beatty, Doctoral thesis, Graduate School, Univ. of Illinois, 1917, p. 32-37.

2. *Ibid.*, p. 87.

It is apparent that these schools were successful because their instruction was closely connected to the work situations and made the responsiveness of the class towards learning much greater. Bueneme can profit from this tenet by keeping their instruction abreast of field developments and include projects in their curricula that have definite and easily discernible connections with problems in the field.

Much of the corporation schools' curricula was designed to prepare the employee for the assumption of higher authority and responsibility.[1] The advanced schools of Bueneme appear to require much more emphasis upon leadership principle and instruction in the execution of authority.

Vestibule Schools

Vestibule schools were used with great success to meet the challenges to industry of the first World War. World War II resulted in the dusting off, and bringing up to date this method of training and it was used to great advantage where it was vital for a concern to train large numbers of men on machine operations especially on today's complicated machines.

This method of training is used to instruct large numbers of employees, primarily in unskilled or semi-

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1. Ibid., p. 42-44.

skilled work, in a relatively short period of time.[1] The program is accomplished with the least amount of disturbance to the regular flow of production and to the routine of the trained working force. Although there are many variations of this plan, all vestibule training programs follow the same general outline. A miniature set-up is created of the department for which the training is carried on. Machinery similar to that in operation on the production floor is utilized. New employees are given a course in training on the particular machines that they will be expected to operate when they become a part of the regular production force. The conditions of work in this training section are controlled to permit the best results to be obtained in the shortest time.

Vestibule training fits neatly into the training picture. Training-on-the-job, in an abnormal employment situation results in many serious difficulties, the major of which is the confusion in the flow of production with the resulting decrease in production. Vocational schools merely furnish a preparatory basis upon which industry must elaborate. For highly skilled jobs, either training-on-the-job or apprenticeship should be used. Preparatory knowledge can be taught by vocational schools. Vestibule

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[1] A. E. Dodd, and J. O. Rice, How to Train Workers for Industries, New York: Harper and Brothers, Publishers, 1942.

training can prepare employees for actual production work.[1]

The need for vestibule schools has been recognized by a number of important enterprises in the United States. Among these may be listed: Wright Aeronautical Corporation, Western Electric Company, Sperry Gyroscope, Aluminium Company of America, Chain Belt Company, Allis-Chalmers Manufacturing Company, and Farrel-Birmingham Comoany.[2]

There are many problems inherent in this system of training. Location and space required for the vestibule school present difficulties that often are resolved only by decreasing the value of the training. The school should be located as close to the actual production area as possible and should be large enough to contain all the machinery that is to be operated by the trainees when they are placed on the production line. In an expanding industry these conditions are often impossible to meet and the school must be placed entirely separate from the industry with the resulting loss of motivation furnished by the real, work-a-day conditions.[3]

Programs which operated during the war averaged from two weeks to three months with the majority requiring at least one month. On relatively simple machines or hand-

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[1] *Ibid.*, p. 60.

[2] *Ibid.*, p. 60.

[3] *Ibid.*, p. 62.

assembly operations a fixed schedule is maintained. When the operation is difficult or involved a flexible training period is employed which takes into account the principle of individual differences. Training is continued until the trainee shows sufficient proficiency on the operation to be placed on the production line.[1]

Instructors for these schools are obtained from within the plant with few exceptions. The fact that an insider knows more about the operations and needs of the business than an outsider should not be underestimated. There are many short cuts and tricks of the trade in particular operations that are known only to the company worker. There are many cases where this knowledge is more vital than many additional hours of training.[2]

The training load placed on each instructor varies from six to ten trainees depending upon the intricacy of the operation, but the desirability of obtaining well-trained employees should prevent overloading of instructors. The aim of concerns which maintain vestibule schools seems to be to turn out workers trained to a minimum acceptable standard in the shortest possible time.

Dodd and Rice evaluated vestibule training and found that this system of training eliminated confusion and

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1. *Ibid.*, p. 62-64.

2. *Ibid.*, p. 64.

the resulting decrease in production inherent in on-the-job training.[1] Trainees' nervousness is eliminated or minimized and accidents are prevented. Rules, regulations, and work habits are learned before entering the production area, and breakage, use, and misfits are minimized through proper supervision. Dodd and Rice concluded that vestibule training supplemented other methods of training where they were weakest.[2] Its value was greatest where large numbers of men were to be trained on unskilled or semiskilled machine or mass-production operations in a relatively short period of time.

It appears that vestibule training has little to offer Hueneme except to point up the importance of a flexible method of instruction. Individual differences play an extremely important part in all learning processes and some accounting for them must be made in all good instructional programs.

One other item of interest to Hueneme is in the selection of instructors from within the plant. Instructors at Hueneme should be cognizant of procedures and methods currently in use in the field. Close synchronation with field problems, procedures, and equipment must be maintained. At the same time, however, Hueneme's schools must keep

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[1] Ibid., p. 65-67.

[2] Ibid., p. 67.

abreast of developments in civilian fields. The establishment of the Civil Engineer Laboratory at Port Hueneme makes this requirement relatively easy. Close contact should be maintained with this laboratory so that trainees can be informed of new equipment, processes, and procedures.

On-The-Job-Training

In most cases in the industrial world the surest, quickest and most thorough way to train a new man is on the job. No expensive duplication of plant facilities is required, and extensive procedures are unnecessary. This method is the most wide spread and perhaps is the only one available to the great majority of concerns which are not large enough to support more formalized systems.

The principle feature of this plan is the selection of experienced operators on the various types of machines and operations. These men break-in the new men. Individual instruction is given in this manner, and the teaching progresses as rapidly as the learner can master it. The essential points to remember in this method is the selection of instructors who not only are experienced on the machines and operations to be taught, but also must be capable of instructing. Selection of trainees should also be given careful consideration since considerable expense is involved in training each individual and failures are costly.[1]

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[1] Dodd and Rice, *op. cit.*, p. 56.

On-the-job-training can play much more important roles than breaking in new men however. The instruction of experienced workers in new skills can be done in this manner very successfully if proper care is taken in the selection of the instructors.

The Wright Aeronautical Corporation placed new employees, after completion of a pre-employment course, in a regular production operation under the guidance of a well-experienced machine operator. After six to eight weeks of this supervision, the trainee is qualified as a machine operator.[1]

The Bethlehem Steel Company found that a six weeks training period was satisfactory for most crafts.[2] It was not expected that men trained in this length of time would be all-round skilled craftsmen but some degree of proficiency in simple skill jobs may be acquired and a foundation for further skills established. All training except for those subjects which must be taught by classroom methods was done on the job under the supervision of an instructor. In some cases it was advantageous to use practice materials, but every effort was made to avoid this whenever possible as it was believed that the trainee learns best when he is actually working at a production task.[3]

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1. *Ibid.*, p. 34-49.
2. Dodd and Rice, *Op. Cit.*, P. 55-56.
3. *Ibid.*, p. 57.

The lesson that Hueneme can learn from this method of training is the value of teaching subjects closely akin to field conditions. Better and closer relations with the field should be maintained so that the atmosphere and processes are similar to those found in actual working practices. Seabee training can take cognizance of the helper training procedures and utilize them in furthering the skills while the men are at work in the field.

Supervisory Training

In any period where industry rapidly expands as it did during the last war, emphasis is usually placed on the lack of rank-and-file workers rather than on the shortages of supervisory personnel. Yet the most serious problem is likely to be the lack of adequately trained supervisors. Management learned long ago that foremen cannot be hired, they must be developed. The complexities of modern enterprise require each industry to develop competent supervisors for its own needs.[1]

Future needs for supervisors should be anticipated and a pool of qualified men developed. Many concerns offer supervisory training on a voluntary basis, but trainees often expect recognition for completion of these courses even though no job offers will be forthcoming. Failure to be selected for supervisory positions will cause disap-

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1. Ibid., p. 57.

pointments with the resulting detrimental effect on morale. Progressive concerns tend to use outside services, such as state universities or vocational educational departments, for courses of this nature.

The simplest, oldest, and most common method of training supervisors is known as the understudy method.[1] Personnel are trained in this system by observing the techniques and procedures of the instructor in handling supervisory problems as they arise in actual day-to-day routine of the plant. The trainee acts as an assistant and learns by absorption. The disadvantage of this method is that the trainee can learn just so much as the instructor knows and is able to impart to his student. Considerable "in-breeding" is inherent in this procedure and often leads to wholly unbalanced supervisory practices.

Functional organizations were developed as modern businesses increased in size and as specialization became the order of the day so that that executive responsibility could be maintained while still obtaining the fruits of specialization.[2] This change in organization made the understudy method of training supervisors even more unsatisfactory, since the instructor was now a specialist in only one field and could not pass on the experience and

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1. Dodd and Rice, Op. cit., p. 89.

2. Dodd and Rice, Op. cit., p. 91.

knowledge of the other branches of the business. Management soon recognized this problem and developed the rotation-of-assignment system of instruction.[1] This method was a distinct improvement over the understudy procedure, but it still retains the flaw that the instruction depends upon the knowledge of the supervisor doing the instructing and upon his skill in disseminating it to the learner.[2] This method presupposes a liberal staffing of the organization so that personnel can be rotated through the various departments of the company. Its value lies principally in training other than direct supervisors and it is used quite widely by the larger concerns.

Early leaders in supervisory training recognized two basic ideas: that within the organization there is experience in all phases of management; and that experienced men are likely to react unfavorably to training on a classroom basis.[3] The Conference method was developed in line with these two ideas. In this system each member of the group was expected to contribute ideas out of which the problem before the conference could be resolved. Continued use of this method developed habits of logical approaches to the solutions of problems. It soon became evident that

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1. Dodd and Rice, *Op. cit.*, p. 93.
2. Dodd and Rice, *Op. cit.*, p. 93.
3. Dodd and Rice, *Op. cit.*, p. 93.

there was danger that these conferences would stress those features which were of special interest to the more dynamic members of the groups and thus leave gaps in the coverage of the management of the concern. It also became apparent that the conferences could not be restricted to a single level of supervisors since this procedure would allow differences of opinions on various procedures and principles to arise between the different levels.[1]

The modified conference system was devised to correct this weakness. In this method the agenda was fixed by top management and in this way assured complete coverage of the field without unnecessary repetition. Statements of company policies and the underlying principles were presented to the conferences to insure uniformity in the development of thinking among the various divisions of supervision within the company.

Socony-Vacuum Oil Company approached the problem of supervisory training by making a job analysis of each supervisory position in the company.[2] In this manner complete cooperation was obtained from all levels because, through knowledge of each other's problems, responsibilities and authorities, lack of interest, lack of information, lack of understanding was eliminated.

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1. Dodd and Rice, *Op. cit.*, p. 95.

2. Dodd and Rice, *Op. cit.*, p. 97.

The General Foods Corporation developed a procedure wherein information was obtained from each level of supervision.[1] This information was used as a basis for constructing company policy and procedures, thus insuring uniformity throughout the corporation.

The Carnegie-Illinois Steel Corporation supplements its training of supervisors by Case Studies.[2] In this method cases concerning disciplinary action, equalization of wages, seniority, distribution of hours, and similar problems are outlined briefly in a paragraph or two. Following this description is a series of true-or-false questions. These questions focus attention on specific aspects of the case and stress points which might cause confusion.

These questions are answered by supervisors at a group conference and whenever there is a difference of opinion, the conference leader proceeds to thresh out the problem by use of conference techniques. Carnegie-Illinois believes that real training is obtained in this manner and it has proven effective in training foremen to take an analytical approach to personnel matters. Management can keep a finger on supervisory attitudes and opinion by this method and a rapid development of policy based on the needs experienced at the applied level is obtained.

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1. Dodd and Rice, *Op. cit.*, p. 97.

2. Dodd and Rice, *Op. cit.*, p. 102-108.

The Federal Training Within Industry Program

The necessity for a new and integrated training program for industry became apparent early in 1940 when this country began to expand its industry for the struggle that lay ahead. First revelations showed an immense shortage of skilled and semiskilled workers and that the existing training facilities were woefully inadequate to supply the required needs. Industry had become accustomed to filling its manpower needs from that vast army of unemployed that was a feature of the 1930's. Existing state and local vocational educational programs could supply only a small part of the training that was needed.

The emergency of 1940 demanded an immediate and increasing supply of workers in numbers and skills never before imagined. New processes, new weapons, and the pressing need for speed created a challenging situation that resulted in management, labor, and government cooperating to provide the solution. This cooperation gave substance to the Training Within Industry Program.[1]

This program achieved tremendous accomplishments in the field of industrial training. Top personnel from management, labor, and education were called in to formulate training procedures to fit specific problems where bottlenecks were impeding the defense program. Although this

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1. Dooher, *op. cit.*, p. 1.

program is no longer active, its history can furnish much of value to use as a basis for building a successful training system.

Four specific programs were evolved by the T.W.I.[1] from their experience in assisting industries with their training problems. These programs were: Job Instruction Training, Job Methods Training, Job Relations Training, and Program Development. By the use of these programs T.W.I. carried out its mission very successfully.

Job Instruction training was an intensive program of ten hours instruction designed to give the job instructor or supervisor practice in how to break in new men on jobs. The training consisted of short practice units for personnel, who, in turn, gave training to men on the job. This procedure was especially successful in solving production, safety, personnel, and quality problems.

Job Methods Training was a series of short, intensive practice units designed to show the supervisor how to simplify and improve the methods of the job he supervises. This program required ten hours for completion and in general followed a four step procedure as follows: Breakdown of the job, Question every detail, Develop the new method, and apply the new method.

Job Relations Training also was a short, intensive

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[1] Dancher, *Op. cit.*, p. 262.

training program designed to give supervisors pointers and practice on how to work with people. Its objectives was the development of abilities necessary to elicit cooperation and to promote teamwork among workers.

Program Development was designed to train men capable of developing and instituting ready-made training programs to meet individual training needs. An intensive coaching course was originated which specifically showed training men how they could develop their own in-plant programs by proper planning, operation, and improving. The course consisted of two two-day periods spaced ten days apart. It stressed a four step program: Spot specific needs, develop a specific program, get management's backing, and follow through. This was the least used of the four plans principally because it was the last to be developed.

Other phases of the T.W.I. program were concerned with upgrading of workers, transferability of skills from one industry and area to another, proper selection of the trainee, and off-the-job training. However, these phases of T.W.I. program were covered more completely by other agencies.

Summary

From the foregoing, it is apparent that the majority of the training programs are developed to meet the requirements of rapidly expanding industries. In ordinary

times, all but the very largest concerns do little in the way of formal training beyond supervisory improvement. It appears that no substitute has been invented for the age-old institution of apprenticeship, especially in the skilled trades which are the important ones as far as Seabee training is concerned.

The new methods of Job Instructor Training, Job Relations and Job Methods Training, and Program Development have important uses for Seabee Training, but their application is perhaps more akin to programs to be developed in the field. In fact, the whole program of training within industry points up the fact that definite, standards and procedures should be developed for use in the field so that the training received at Hueneme can be used as a basis on which a well-rounded skill can be built.

Class A schools, at Hueneme, appear to approximate pre-employment, orientation, or pre-production training. Class B schools more closely approximately refresher, supplementary, or supervisory training. The emphasis that industry places on foreman or supervisor instruction leads one to believe that Hueneme would profit by expanding leadership and instructor training in the Class B schools. Although the Class B schools are designed for the training of personnel to meet the requirements of the examination for first class petty officer, the school is also used to refresh first class and chief petty officers in the duties

of their rate.

From a survey of the Training Within Industry Program, it would appear that Class B schools should receive the most attention. Supervisory training proved to be the key to the success of the entire training system of the last war. The addition of instructor training, job method and job relations principles in the Class B schools' curricula seems to be worthy of consideration. The Navy has always emphasized the importance of supervisory and leadership abilities in petty officers without instituting formalized instruction in these fields. The adoption of these principles gathered by the T.W.I. should enhance the value of petty officers to the Seabees.

In the same vein, it should be noted that the conference method was designed to overcome a difficulty that is also prevalent in the service. That difficulty is the danger of differences of opinion on matters of policy and principle arising between the different levels of authority within the service. It is not recommended that conferences be held each time that a decision is to be made, but the underlying principles and policies of the various courses of action could be discussed very effectively in this manner.

Most of the training practices in effect in industry are used to some extent in the Seabees. Observer, on-the-job, remedial, conversion, and supplementary training are used but in a non-formal manner and usually is done by the

various units in the field.

Above all, it should be noted that industry's instruction is specific. Little attempt is made to develop all-round craftsmen. Seabee Training, on the other hand, is exactly the reverse. Every man is trained to be a skilled artisan in the trade selected. Such a goal raises problems in motivation and the maintenance of an atmosphere comparable to the workaday environment.

CHAPTER V.

FORMAL EDUCATIONAL INSTITUTIONS

Introduction

Emphasis on trade, vocational, and industrial education can be said to date from the Smith-Hughes act of 1917. By that act a Federal Board for Vocational Education was established and federal aid was made available to this type of education. There had been many schools which instructed in various aspects of the industrial field but the impetus supplied by this law resulted in a new outlook and acceptance by educators in general.

Perhaps the first point to be delineated is the meaning of the various terms applied to methods of instruction. One hears the terms industrial education, industrial arts, vocational education, manual training, and the like and great difficulty is experienced in defining what is meant by each term. The following definitions are included to clarify this point:

Vocational Education:- is any form of education, whether given in a school or elsewhere, the purpose of which is to fit an individual to pursue effectively a recognized profitable employment, whether pursued for wages or

otherwise.[1]

Pre-Vocational Education:- is those programs of instruction and training designated to assist an individual in making an intelligent choice of an occupation, through giving him opportunity to participate in a series of practical experiences related to many vocations.[2]

Industrial Education:- includes those forms of vocational education, the direct purpose of each of which is to fit the individual for some industrial pursuit or trade.[3]

Manual Training:- is the oldest form of organized practical industrial work in the public schools. It is elementary in form and is used as a basis on which to build a technical education. Its motive is educational, not vocational. No attempt is made to teach a trade and the pupil receives only a general acquaintance with mechanical and constructive activity.[4]

Manual Arts:- is that form of practical handwork in wood, metal, clay, basketry, etc. wherein the student first designs an artistic object and then carries it out

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1. David Snedden, *Vocational Education*, MacMillan Co., 1920, p. 535.

2. Vocational Secondary Education, Bulletin #21, 1916, U.S. Office of Education.

3. David Snedden, *Vocational Education*, MacMillan Co., 1920, p. 537.

4. F. M. Leavitt, *Examples of Industrial Education*, Glenn & Co., New York: 1912, p. 16.

in the material.[1]

Arts and Crafts:- is similar to manual arts except that manual arts is part of the curriculum of primary grades while arts and crafts is taught in secondary schools.[2]

Industrial Arts:- includes those forms of study and training based upon industrial pursuits and designed to enhance general vocational guidance in the field of industrial occupations.[3]

From the above definitions it is possible to delimit this survey to those forms of education which bear directly on the task of training individuals for one specific vocation which is similar to the mission assigned to Port Hueneme. By limiting the field in this manner, it is possible to investigate the programs offered by vocational, trade, and technical high schools and the new terminal courses now being offered by junior colleges in various parts of the country, and eliminating those courses that are essentially general in nature or else are preparing graduates for further education in the engineering field.

Trade and Industrial Schools:- These schools under

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1. Vocational Secondary Education, Bulletin #21, 1916, U.S. Office of Education, p. 67.

2. A. F. Payne, Administration of Vocational Education, McGraw-Hill Book Co., Inc, New York: 1924, p. 25.

3. David Snedden, Op. cit., p. 549.

both public and private administration have played an important part in the American education system. Before 1917 these institutions were limited in numbers and restricted to highly industrial areas. The Smith-Hughes act provided the stimulus needed for rapid expansion of this system of education, and schools of this ilk sprang up over almost all of the United States. Many labels have been attached to these institutions; they have been called trade schools, industrial schools, vocational schools, industrial high schools, vocational high schools, and names of similar nature. These schools usually offer both day and evening classes. The primary objective of the day program is to prepare young persons for effective entrance for wage earning into the skilled trades. The primary objective of the evening program is the upgrading of employed workers.

The William Hood Dunwoody Industrial Institute of Minneapolis, Minnesota; the Milwaukee Vocational School; the David Rankin, Jr., School of Mechanical Trades, St. Louis, Mo., and the Frank Wiggins Trade School of Los Angeles, California are examples of public and private trade and industrial schools which offer vocational courses to persons who can profit from the instruction.[1]

Table 9 is an example of the type of program

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[1] U.S. Dept. of Education, Vocational Division Bulletin #228, Vocational Technical Training for Industrial Occupations, Govt. Printing Office, Washington, D.C.: 1946.

offered by the Public Trade School of San Bernardino, California.[1] This course is typical of those offered by schools of this type and is comparable to the training given at Hueneme. The requirements for entrance to this course list the age limits as 16-22 years of age. Candidates must be physically sound, of average height, have good eyesight, possess an aptitude for mechanics and accuracy, and present a neat personal appearance. A background of drawing and arithmetic is essential and graduation from high school is recommended. The course requires twenty months to complete and upon graduation qualifies the student to enter the electrical trade as an advanced apprentice.

The activities are presented in progressive order. The work starts with the simple jobs and advances to the more difficult. Unrestricted progress in accordance with his ability is afforded the student. Credit is given for skill or knowledge gained previously in school or industry and training proceeds from the point where the student has the ability to carry on.

There are three general objectives of this course:

1. To develop the ability to do definite jobs specified in the different employment levels.
2. To develop the ability to understand the facts and principles that condition the job.

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[1] *Industrial Arts and Vocational Education Magazine*, "Vocational Electrical Training," Mark McMillian, June 1944, p. 248.

3. To develop the ability to understand and appreciate the industrial relations that affect the job.

The comparison of the course at the Public Trade School and that offered by Hueneme as indicated by Table 9 clearly bring out the fact that the Seabee program places emphasis upon principles and theory and leaves the practical experience to be obtained in the field. This does not mean that any attempt is being made to train electrical engineers, but, rather, there is a desire to train all-round electricians and not to develop fully qualified interior wiremen, motormen, or outside electricians. The course at San Bernadino stresses the subjects that will enable their graduate to obtain and retain positions in industry. The vast difference in the time allowed for completion of the Public Trade School course as compared to that allowed the Seabee must make the aims and objectives totally dissimilar. The use of prevocational training for selecting and preparing students for entrance into the program has implications for Hueneme. It would appear that Hueneme starts their course with more elementary subjects and continues beyond the level obtained by San Bernadino. In order to obtain this coverage it is necessary to sacrifice the practice and experience that is one of the cardinal principles of vocational training. This course of action could, perhaps be justified if definite action was taken to follow up this instruction with supervised experienced in the field.

TABLE 9.

COMPARISON OF ELECTRICAL COURSE AT SAN BERNARDINO PUBLIC TRADE SCHOOL AND THE PRIMARY ELECTRICAL COURSE AT PORT HUENEME

Public Trade School San Bernadino, Calif.		Primary Electrical Course at Port Hueneme.	
Courses	Hours	Courses	Hours
Prevocational Training		Electrical tools Wire sizes Wire splices Soldering & taping Mathematics	2 1½ 3 3 21½
		Subtotal	31
House Wiring Read blueprints & specifications Design lighting & power layouts Install Electrical Services Install Meter loops Install proper grounding Install lighting circuits Install appliances circuits		Electrical Symbols & Blueprints Interior Wiring	12 55
Subtotal -	500	Subtotal	67
Electrical Construction & Operation Power switchboards design & operation Single phase motor installation Two phase motor installation Three phase motor installation A.C. & D.C. Generators		Basic principles of Electricity Motors, Generators, & Transformers	61 56
Subtotal -	500	Subtotal	117
Motor & Generator Winding & Repair Motor & generator Tests Redesign of Wiring Rewind of motors & generators Shaft & Bearing Maintenance			
Subtotal -	500		
Electrical Appliance Service & Repair Testing & recognition of defective parts & adjustments Installing new parts & making proper adjustments			
Subtotal -	500		
		Telephones, switchboards & telephone equipment- Pole line construction	85 60
		Subtotal	145
Grand Total	2000	Grand Total	360

In order to accomplish this phase of the learning process, it is recommended that steps be taken to develop a program to standardize the experience obtained in the field so that the principles imparted at Hueneme can be driven home and retained by the student as real learning.

Technical High Schools

The concept of technical high schools varies widely from location to location. In some places technical high schools are highly developed technical institutions with extensive laboratory facilities and well developed curricula. In other places, they are merely schools offering general high school curricula with a few scattered courses in practical arts. The present trend is away from the general industrial approach and leans towards specialized programs in one field. Most schools have a dual purpose, however, in that they are preparing young men for entrance upon employment of definite technical character and on the other hand readying them for entrance to engineering colleges.[1]

The essential differences between technical high schools and vocational-industrial or trade schools is that the technical schools place less emphasis upon the development of the manipulative and machine operating skills and more emphasis upon the acquisition and use of technical information. The proportion of laboratory as compared with

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[1] Vocational Division Bulletin #228, Op. cit.

shop work is also higher in the technical school.

Most technical high schools consist of a four year course and has become more and more selective.[1] Completion of the course requires more than average abstract thinking and an effort is made to select those of higher intellectual ability. These schools are spread over the entire United States and include Lane Technical High of Chicago, Cass Technical High School of Detroit, Arsenal Technical High School of Indianapolis, Rindge Technical High of Cambridge and Baltimore Polytechnic Institute of Baltimore, Maryland.

Interest in these schools is increasing and the New York State and the Texas technical high school programs are typical of the trend in this direction. The New York program is worthy of examination. The curricula in these institutions are built around specific fields and comprehensive examinations are given to measure the competency of graduates of these courses. The industrial fields covered by the curricula include architecture, building construction, industrial chemistry, electricity, mechanical design, power generation, structural design and textiles. General education subjects required for all high school curricula are also included, and especially strong offerings in mathematics and physical sciences are required for use as a basis for the courses in the field of specializa-

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1. Ibid.

tion. All programs include liberal amounts of laboratory work.[1]

Instructors are required to have adequate technical training and industrial experience. Provisional licenses require the completion of an approved four year program in engineering or applied arts, three years of approved technical experience in industry and the completion of 18 semester hours of approved courses in professional education. Permanent licenses require additional courses in education or technology.

Table 10 indicates the rise of enrollment in technical high schools in New York State and emphasizes the increased interest in programs of this type.

TABLE 10.

GROWTH OF TECHNICAL HIGH SCHOOL PROGRAMS IN N.Y. STATE

School Year	Tech. H.S. Enrollment
1920-21	309
1925-26	3,162
1930-31	8,632
1935-36	13,419
1940-41	15,399
1941-42	16,000
1945-46	13,876
1946-47	14,378

Table 11 is an example of the type of course offered by a technical high school. Table 12 is a comparison of another technical high school course with that

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1. Ibid.

offered by Port Hueneme. The course described in Table 12 was designed to meet the needs of students for induction into industry. This course was introduced into the Omaha (NEB.) Technical High School during the last war and was very successful in training personnel for the armed forces and for employment in the industries located in that section of the country.[1] Additional courses were available for students already employed and lectures were given daily to cover topics missed by industry's training programs. Considerable innovations were used in the methods of teaching these courses, armature circuits were taught through the use of visual slides, three-phase motor connections were explained by assigning students to outlined motor connections on a skeleton motor projected on the blackboard by lantern slide.

Requirements for entering this course of electrical instruction included the completion of one year of pre-vocational electricity. This pre-vocational course was developed by the War Department and is a general introduction to the field of electricity. The daily program is broken up into six periods and two of these are used for related material, informal discussions, questions and answers. These periods are known as trade knowledge and are given in sequence

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1. Industrial Arts, Vocational Education Magazine, "Tooling the Electrical Course for War," Don R. McCahill, March 1945, p. 123.

TABLE 11.

THE ELECTRICAL CURRICULUM AT BROOKLYN TECHNICAL HIGH SCHOOL

First Year	1st Term	2nd Term
English	5	5
Mathematics	5	5
Civics	2	3
Industrial Processes	5	5
Tech & Free-hand Draw.	5	5
Shopwork	10	10
Hygiene	1	-
Health Educ.	2	2
Music	-	1

Second Year	1st Term	2nd Term
English	5	5
Mathematics	5	5
Chemistry	5	5
Tech Draw.	4	4
Freehand Draw.	2	2
Shopwork	10	10
Hygiene	1	-
Health Educ.	2	2
Library	1	-

Third Year	1st Term	2nd Term
English	5	5
Mathematics	5	5
Physics & Physical Measurement	10	10
Elect. Draw	4	4
Shopwork	5	5
Hygiene	1	-
Health Educ.	2	2

Fourth Year	1st Term	2nd Term
English	5	5
History	5	5
Economics	-	5
Gen., Motors & Power Distrib.	10	-
AC & Commer. Test.	-	10
Elect. Constr.	5	5
Radio	5	-
Hygiene	1	-
Health Educ.	2	2

Subjects of common interest to Brooklyn Tech and Hueneme

	Brooklyn Tech	Hueneme
Mathematics	510	
Tech. & Freehand Draw.	510	
Shopwork	850	
Physics & Physical Measurement	340	
Gen., Motors, & Power Distrib.	170	56
AC & Commercial Testing	170	
Electr. Constr.	170	
Radio	85	

TABLE 12.

ELECTRICAL CURRICULUM AT OMAHA (NEB.) TECHNICAL HIGH SCHOOL

First Year - First Semester
120 Hours of Trade Knowledge - Blueprint reading and estimating
240 hours of Shopwork
Construction of Electric Arc Soldering Rig - given in connection with job and information sheets to enable student to develop general mechanical skill, ability to follow instructions carefully, and to develop neatness in production.

First Year - Second Semester
120 Hours of Trade Knowledge - house wiring circuits and the national code
240 Hours of Shopwork
House Wiring Circuits - given with job information sheets to enable the student to apply some of the provisions of the electrical code as well as to acquaint him with the circuits in house and power wiring. A full course in house wiring cannot be taught in the school laboratory and this unit is designed to help the boy to discover if he is fit and capable of becoming a house wireman. Experience is given in the servicing of the school's lighting system.

First Year - Third Semester
120 Hours of Trade Knowledge - Armature circuits and alternating currents
240 Hours of Shopwork
Alternating Current Measurement - given through the use of job sheets and reference books. Purpose of unit is to give the student experience in the use of devices to measure Alternating Current and to discover some of the applications of Alternating Current. This knowledge is of general nature, applicable in any job.

Second Year - First Semester
120 Hours of Trade Knowledge - Alternating Current motors and controls
240 Hours of Shopwork
Cable Splicing and Telephone Work - Job sheets, information sheets and reference direct the work in this course. The purpose is to discover whether the student has the "fine touch" and high mental coordination so necessary in legiti-

TABLE 12. (Continued)

mate telephone work. Students are used to service the school's telephone system.

Second Year - Second Semester
120 Hours of Trade Knowledge - Vacuum Tubes
240 Hours of Shopwork
Vacuum Tube Work - Job and information sheets and reference books are used. Unit is designed to give the student experience in the use of vacuum tubes in all fields.

Second Year - Third Semester
120 Hours of Trade Knowledge - Electrical Refrigeration
240 Hours of Shopwork
Continuation - this unit permits the student to continue in the field of his own choice. Exploration is continued under supervision in the various phases of electricity. The student learns to work under poor conditions and to create new tools for new situations. He is encouraged to further educate himself through the study of advanced reference books.

so that the student will get a full series in two years regardless of the time he enters. The remaining four periods each day are devoted to shop work. The school year is divided into twelve weeks quarters and one subject is taught in each quarter. Table 12 is a summary of the subjects in the two year period. This school was very successful and graduates served with the CB's in the last war. The program is similar to Hueneme's in many respects and the school seems to have been very successful in obtaining high motivation throughout the course. Further study of the teaching techniques would appear to be worthy of investigation.

Technical Institutes

Technical Institutes, viewed generally, are schools which offer "programs essentially technilogical in nature and intermediate between those of the high school and the vocational school on the one hand and the engineering college on the other." The Society for the Promotion of Engineering Education made a survey of technical institutes in 1931 and defined the scope of technical education in these schools as follows:[1]

> More practical in aim and more direct than the usual instruction of the engineering colleges; more advanced in character than the instruction commonly given in high schools and trade schools; distinctly technological and industrial in content; shorter in duration than a college course for a but not less than one school year or its equivalent in length; closely related to the

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1. Vocational Division Bulletin #225, op. cit.

> student's present or prospective field of employment; comprised in a curriculum of related subjects organized as a terminal course rather than one preparatory for more advanced courses; not confined exclusively to a single technical branch, but including related scientific or liberal subject matter.

The technical institute was an European invention and was introduced into this country primarily as a private institution, often as an endowed school for underprivileged youths. Except for New York State this field is still dominated by private schools, such as the Wentworth Institute, Boston; Rochester Athenaeus and Mechanics Institute; Franklin Institute, Boston; Drexel Institute, Philadelphia; and the Pratt Institute, Brooklyn. Table 13 is an example of the type of course offered by institutions of this type.

The tendency of these schools is to confine their instruction to one specialized field and in so doing are able to go deeper into the field, provide extensive equipment, and can establish close working relations with placement opportunities. Graduates have shown positive adaptability in the following phases of industry in the order listed:[1]

1. Supervision in operating departments
2. Plant operation and maintenance
3. Getting on with workmen
4. Technical service (drafting, testing, inspection, etc.)
5. Teamwork with associates
6. Cooperation with executives
7. Construction and erection in the field
8. Accepting plant hours and conditions
9. Technical sales work.

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[1] *Ibid.*

TABLE 13.

THE INDUSTRIAL ELECTRICITY CURRICULUM AT THE FRANKLIN TECHNICAL INSTITUTE, BOSTON, MASSACHUSETTS

First Year	First Term			Second Term		
	Rec. Lect.	Lab. Draft	Study	Rec. Lect.	Lab. Draft	Study
D.C. Electricity	3	6	7	4	6	8
Alegbra & Trig.	4	0	6	3	0	4
Gen. Chemistry	2	2	3	2	2	3
Physics	2	2	2	2	2	3
Mechanical Drawing	0	3	0	0	3	0
Mechanism	0	0	0	2	0	2
Electrical Wiring	1	3	1	1	3	1
English	2	0	2	0	0	0
Second Year						
A.C. Electricity	5	6	9	5	6	9
Calculus	2	0	3	2	0	3
Electronics	1	3	3	1	2	2
Electrical Wiring	1	3	1	1	3	1
Electrical Drafting	0	3	0	0	2	0
Economics	2	0	2	0	0	0
Business Law	0	0	0	2	0	2
Gasoline Engines	2	0	1	0	0	0
Thermodynamics	0	0	0	2	2	3
Strength of Materials	2	0	2	0	0	0
Industrial Chemistry	0	0	0	2	0	1
Third Year (Optional)	Advanced Industrial Electrical					
Mathematics	3			3		
Electronics	2			2		
A.C. Machinery	4			4		
A.C. Circuits & Trans.	3			3		
High Voltage Engineering	2			2		
Seminar	3			3		
* A.C. Machinery		13			13	
A.C. Currents & Electronics		13			13	

* A student may select, upon consultation with the department, one of the laboratory options to make up a 30 hours per week program.

New York State Technical Institute Program

New York has taken the lead in establishing technical institutes for their citizens. This program is based principally upon the Agricultural and Technical Institutes, which were established in 1906, and the Institutes of Applied Arts and Sciences, which were established in 1946. Six Agricultural and Technical Institutes and five Institutes of Applied Arts and Sciences are in operation at the present time.

The objectives of the Agricultural and Technical Institutes are first, to provide instruction designed primarily for technical employees serving rural areas, in agriculture, home economics, and industry, together with such other fields of instruction as may be approved by the regents of the University, by means of full time courses, part-time courses, short-unit courses, cooperate and evening courses, and home study and correspondence courses; and second, to conduct such demonstrations, experiments, lectures, farmers weeks and such other educational activities at the institutions as will promote the vocational and technical practices of the state.[1]

The Institutes of Applied Arts and Sciences have as their objective the preparation of young men and women for technical and semi-professional positions in industry. The

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[1] Shephard, Op. cit.

Laws of New York 1946 state the purpose of these schools is to provide education and training in applied arts, crafts, aeronautics, retail business management, sub-professional and technical skills, through curricula not to exceed two-years in length, including related work in the arts and sciences and other subjects essential to the general welfare and understanding of students together with courses on an extension or part-time basis.

Table 14 is a summary of the curricula given at these institutions that are comparable to those in operation at Hueneme. It appears that this program offers a complete coverage of the industrial fields but little emphasis is placed on the construction trades. The curricula are designed from an industrial or engineering technological background rather than from the trades viewpoint. The plan expects the student interested in a vocational trade education to attend the vocational high schools as described previously. These technologies frequently incorporate a work experience requirement as a feature of the curriculum. This requirement often consists of employment at prevailing pay rates but may simply mean the performance of work activity performed regularly in an industrial concern under supervision of both employer and school personnel. Cooperative arrangements between the schools and enterprises in a community control the work situations for students of the technologies.

TABLE 14.

CURRICULA OF THE NEW YORK STATE TECHNICAL INSTITUTES THAT ARE SIMILAR TO THOSE OFFERED AT PORT HUENEME

Title of Curricula	Agricultural & Technical Institutes	Institutes of Applied Arts & Sciences
Automobile Mechanics	1	
Automotive & Diesel Technology	1	
Chemistry Technology	2	2
Industrial Chemistry	2	
Building Construction	2	2
Highway & Bridge Construction	1	
Industrial Construction Service	1	
Electrical Equipment	1	
Electrical Machinery & Power	1	
Electrical Machinery & Power (3 year curriculum)	1	
Electrical Technology		5
Electrical, General	1	
Electricity, Technical	1	
Heating, Plumbing, Air Conditioning	1	
Machine Shop	1	
Mechanical Technology		5
Radio & Communications	2	
Radio Communication (3 yr. curriculum)	1	
Refrigeration & Air Conditioning	1	
Refrigeration & Air Conditioning (3 yr. curriculum)	1	
Structural Technology		1
Technical Drafting & Machine Design	1	

Institute curricula aim to train persons for intermediate positions of a supervisory, managerial or administrative nature for pursuits such as Automobile Mechanics, Building Construction, Technical Electricity, Heating, Plumbing and Air Conditioning, and Machine Shop.

Table 15 is an example of the electrical curriculum offered by one of the Technical Institutes. It is obvious that these curricula place their emphasis upon the theoritical viewpoint and do not train the student required for the performance of maintenance and construction work overseas.

A study of Table 15 plainly indicates the sound, practical organization of the industrial electricity course at the Franklin Technical Institute. Much more emphasis is placed on higher mathematics, allied fields are touched briefly, and the general intellectual level is quite a bit higher than that taught at Hueneme. Franklin Technical Institute, being a private institution can afford to be selective and consequently draws its students from a group with more intellectual and manipulative ability. Although the course is rather impressive, the graduate is offered no more than advanced apprentice standing upon graduation and requires at least three more years of apprenticeship before receiving a journeyman card. Hueneme's course covers much more ground, having units covering telephony, line work, and other methods of communication. In order to cover

TABLE 15.

ELECTRICAL CURRICULUM AT THE CANTON AGRICULTURAL AND TECHNICAL INSTITUTE

Course Title	Class Hours	Laboratory
1. Prescribed General Courses		
Business-Management		
Business Organization & Management	6	
Communication Skills -		
English Oral & Written Communication	6	
Drawing		
Mechanical		6
Mathematics		
Algebra - College	3	
Plane Geometry	3	
Physical Sciences		
Mechanics	4	
Social Sciences		
Social Adjustments	3	
History		
U.S. History & Institutions	3	
Total Semester hours	28	6
2. Prescribed Vocational Courses		
Circuits & Machinery		
Electrical Equipment		4
A-C Theory	10	
A-C Problems		4
D-C Theory	8	
Communications		
Radio	6	2
Construction		
Installations, Equipment, Code, Etc.)	4	
Controls		
Industrial Control	4	2
Drafting		
Electrical Drafting		6
Total Semester hours	32	18

TABLE 15. (Continued)

Course Title	Class Hours	Laboratory
3. Division of time		
Percent of Weekly Hours		
General Courses	35%	
Special-Vocational Courses	65%	
Semester Hour Credit		
General Courses	34	
Vocational Courses	50	
Total Semester Hours	84	
Total Class & Laboratory Hours	113	

these fields; the practice and detail instruction so necessary for really topnotch instruction must be severely curtailed.

The Curtiss-Wright Cadette Program

One of the most interesting programs conceived by industry during World War II was the Curtiss-Wright Cadette program.[1] While the field covered by this course is not very similar in content to the courses available at Hueneme, there are many implications in the idea that illustrate just how much a well organized and administrated program can do in training personnel for positions totally alien to the students' native selection in a relatively short length of time.

The Curtiss-Wright Company became gravely concerned over the shortage of engineering personnel in 1942 and after a detailed study devised a program which took selected young women and gave them a rigorous 44 week program of aeronautical engineering. After graduation these women were placed in engineering and technical positions in the Curtiss-Wright plants. One of the requirements for selection for this course was the completion of two years of college. About 7000 applications were received, out of which 700 girls were selected. Many of these young women had completed college, and naturally there is no comparison as to

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[1] Vocational Educational Bulletin #228, Op. cit.

the quality of student in comparing the program to Hueneme's schools. These seven hundred girls were sent to 7 universities, Penn State, University of Minnesota, Purdue, Iowa State, Texas University, R.P.I., and Cornell. The course was 44 weeks long, divided into four 11 week terms. Each week was 40 hours of instruction, leaving time for home study, field trips, inspections of manufacturing operations, and free time for personnel use. The girls upon arrival at the college to which assigned were divided into smaller groups, these groups being selected upon their ability to assimilate the material to be learned. An attempt was made to progress as rapidly as the group could learn. Table 16 is an outline of the course and indicates the thorough grounding the girls received in aeronautical engineering. The officials of the company were well pleased with the results of the program and it shows just what a short intensive program can do with carefully selected students, well planned curricula, good instructors, and good facilities.

Junior College Programs

The first junior college in the United States was founded at Joliet, Illinois in 1902.[1] By 1948, the number of junior colleges in this country had reached 326. The original purpose of this type of school was the preparation

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[1] Shephard, Op. cit.

TABLE 16.

THE CURTISS-WRIGHT CADETTE PROGRAM

Subject	Term I	Term II	Term III	Term IV
Mathematics	Engineering Math. incl. Trig.	Analytic Geometry	Calculus & Diff. Equ.	Treatment of Engineering data
Mechanics	Introd. to Mech.	Engineering Mechanics	Strength of Materials I	Strength of Materials II
Drafting	Elements of Aircraft Drafting	Aircraft Drafting	Aircraft Drafting & Design I	Aircraft Drafting & Design II
Theory of Flight	Airplane Terminology		Aerodynamics I	Aerodynamics II
Materials Testing			Materials Testing I	Materials Testing II
Processing of Aircraft Materials	Machine Shop Practice	Sheet-metal Shop	Aircraft Materials & Processes I	Aircraft Materials & Processes II
Production Methods				Aircraft Production Meth & Opers.
Job Terminology & Specs.			Curtiss-Wright Eng. Manual I	Curtiss-Wright Eng. Manual II

of the student for college in a local setting. Junior colleges became very popular in California and by 1947, the number of junior colleges had reached 47 and still more institutions are in the planning stage.[1] The junior college although varying in size and type from place to place, is essentially a community institution and therefore has a special obligation to meet fully the needs of its own constituency.

The junior colleges as visualized by its founder William Rainey Harper were essentially preparatory institutions and were concerned with the preparation of youths for further training in recognized colleges.[2] However, as the movement gathered momentum the additional functions of popularizing, terminal and guidance were added and the junior college took on a new aspect and attempted to fill the gap in education created by changing world conditions.

Many factors have exerted their influence on our way of life in these last few years and have caused powerful strains on the educational process. The vanishing of the western frontier has erased an important outlet for the youth of this nation and has turned them to competition with the established order. The increasing of the life span, coupled with technological advancements and the age of per-

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1. Shephard, Op. cit.

2. Shephard, Op. cit.

manent employment, has required educational institutions to devise procedures to more adequately prepare their graduates for successful entry into the keenly competitive world that has developed in this country today. This preparation must not only be for those capable of work of college level, but also must care for those who are best qualified for positions in industry, commerce, and other business which does not require education of the more advanced type.

Technical high schools and institutes were the first steps in the training of youth for careers in industry, but the changes noted above have made this approach a dead-end street. The present view of the matter is that more time can be devoted to teaching the skills required for successful entry into the business world, and at the same time, instruction in democratic living, both in the home and in everyday living, can be profitably given so that our youth will be able to create a better way of life and can make democracy work.

Ells made a survey of junior colleges in which he attempted to determine just what percentage of their students were using the institution to train themselves for entry into permanent employment. In this study he found that junior college was terminal for 75% of the students, although not all of these were enrolled in terminal curricula.[1]

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[1] Eells, Op. cit.

Table 17 and Table 18 are examples of the electrical curricula at the Los Angeles City College and the San Francisco city College. Table 19 is a compilation of the courses offered by California Junior colleges in the industrial fields comparable to those taught at Hueneme.

One of the most progressive junior colleges in the industrial field is the Ventura Junior College which is only some ten miles north of Hueneme. The proximity of this institution should permit interchange of ideas, especially in the training and improvement of instructors and teaching methods.

Although junior colleges are not restricted to any section of the country, California, Texas and Illinois together have 51% of these schools, yet account for only 16% of the country's population.[1] These figures indicate that the junior college has not reached the real industrial centers of the nation and that the majority of our industrial workers are receiving their training in some other type of institution or on the job.

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[1] Eells, *op. cit.*

TABLE 17.

ELECTRICAL TECHNOLOGY CURRICULUM AT THE SAN FRANCISCO CITY COLLEGE

Course Title	Semester Hours
1. Prescribed General Courses	
Communication Skills -	
English for Engineers	6
Drawing	
Machine	2
General	
Engineering Field Trips	2
Health & Physical Education	6
Physical Sciences	
Mechanics	3
History	
U.S. History & Institutions	3
Total General Course Semester Hours	19
2. Prescribed Vocational Courses	
Circuits & Machinery	
D & A Current Circuits	10
D & A Current Machinery	10
Drafting-Layout	
Electrical Drafting	6
Electronics	
Laboratory	1
Fabrication	
Processes - Shop Techniques	3
Manufacturing Processes	4
Welding & Sheet Metal Practices	3
Mechanics-Materials	
Materials of Engineering Construction	2
Surveying	3
Total Vocational Course Semester Hours	45
3. Division of time	
Percent of Weekly Hours	
General Courses	30%
Special-Vocational Courses	70%
Total Class & Laboratory Hours	61

TABLE 18.

ELECTRICAL CURRICULUM AT THE LOS ANGELES CITY COLLEGE

Course Title	Semester Hours
1. Prescribed General Courses	
Communication Skills - English	
Composition	3
Speech	3
Drawing	
Engineering	2
General	
Electives	2
Health & Physical Education	4
Mathematics	
Engineering Calculation	3
Engineering Problems	3
Physical Sciences	
Engineering Mechanics & Heat	4
Heat Engineering	5
Social Sciences	
Economics	3
History	
U.S. History & Institutions	4
Total Semester Hours	36
2. Prescribed Vocational Courses	
Circuits & Machinery	
A-C Circuits & Machinery	5
D-C Machinery & Single phase Circuits	5
Polyphase Circuits & Machinery	
Controls	
Automatic Control Devices	3
Drafting-Layout	
Electrical Drafting	1
Electronics	
Industrial Electronics	3
Hydraulics	
Elementals	2
Mechanics-Materials	
Mechanical Laboratory	1
Applied Mechanics & Strength of Materials	6
Wiring for Light and Power	2
Refrigeration	3
Total Semester Hours	35
3. Division of Time	
Percent of Weekly Hours	
General Courses	42
Special-Vocational Courses	58
Total Class and Laboratory Hours	101

TABLE 19.

TERMINAL TRAINING COURSES IN 47 CALIFORNIA JUNIOR COLLEGES

Course	No. of Junior Colleges	Course	No. of Junior Colleges
Architectural Drafting	12	Mech. Eng. Tech.	3
Auto Body & Fender	3	Pattern Making	1
Auto Mechanics	27	Painting & Decorating	1
Auto Painting	1	Painting Techniques	1
Carpentry, Building Construction	25	Stone Masonry & Cement Finishing	1
Civil Eng. Tech.	3	Photography	17
Diesel Mechanics	5	Radio Tech.	24
Drafting	13	Refrigeration	7
Elect. & Elect. Eng. Tech.	24	Sanitary Engineering	1
Engineering Tech.	10	Sheet Metal	11
Forestry & Lumbering	5	Ship Carpentry	1
Foundry	1	Surveying	1
Industrial Tech. (Gen.)	10	Tool & Die Making	1
Landscape Gardening	4	Truck & Tractor Repairing	1
Machine Shop	32	Welding	18

Above data is restricted to courses in the trade and technical fields and is taken from the 1947-48 catalogues of the 47 California Junior Colleges. University parallel courses have not been considered as terminal in most cases.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This investigation was initiated to survey the training policies and procedures in effect in American educational institutions and industry for the preparation of our youth for entrance into gainful occupations. The study has only touched on the more outstanding phases of our training processes but several generalizations and conclusions can be drawn that can be applied in the training of Seabees.

The conclusions reached by this report are stated below:

1. Apprenticeship is generally recognized as the most satisfactory method of training personnel for practically all of the skilled trades.

2. Apprenticeship is gaining in popularity and is being organized and supported by labor, management and governmental agencies, on local, state, and national levels.

3. Adequate controls are being formulated to control, unify, and improve apprenticeship, procedures to the advantage of all concerned; the apprentice, the management, labor, and the community.

3. Apprenticeship is comparable to an enlistment

in the Seabees and the training and experience are similar.

4. Training, other than apprenticeship, in modern industry is concerned with semi-skilled labor. The advancement in technological methods has decreased the value of the master craftsman and has made possible the utilization of specialists in almost every operation that need to be trained in one or two operations that can be taught in a few weeks.

5. Industry is placing great stress on the training of supervisors. New methods of instruction are being developed in this area.

6. The Federal Training Within Industry Program has been very successful in raising the quality of instruction of new and old workers and its methods are worthy of attention.

7. Vocational and trade educational institutions are gaining in popularity and are experiencing their greatest growth.

8. Terminal courses are increasing in many colleges and are the basis of junior college growth.

9. The current trend of the terminal courses and the technical high schools and institutes is training of technicians rather than craftsmen. The popularity of these courses is based on social changes that required additional schooling, postponement of the age of starting to work and the lack of a place for youth in industry.

10. Vocational high schools are much more important as guidance centers in which aptitudes are determined. Another purpose is the instruction in pre-vocational subjects; the preparation of the youth for learning a trade, becoming familiar with the trade language, and the learning of the elementary, processes of the trade.

11. The teaching of a skilled trade is not readily adaptable to an artificial classroom situation. The classroom should be restricted to instruction in related subjects and the theory necessary for understanding of the trade.

12. The State of California has contrived a very successful plan for apprenticeship by cooperation of all the interested parties.

Recommendations for further study

This study indicated that the transfer of learning possible from formal educational situations is decidedly limited in the areas of the skilled trades. People learn by doing, and the doing must be accomplished under normal work conditions and the motivation must be similar to that operating in actual production situations.

It appears that extensive improvement of Busnome's instructional processes is restricted in the results obtainable. Improvement of the Seabees must be accomplished in the field. Studies of the processes used in the field to instruct Busnome graduates in the duties of their ratings

would be valuable in determining how the instruction could be improved and unified throughout the service. Hueneme should investigate the possibilities of instructing in supervisory techniques and emphasize the theory and background material of each rating.

Since the primary mission of Hueneme is the preparation of the constructionman to third class petty officer, the best method of evaluating the success obtained would be a follow up study of graduates. It would be possible to judge the value of the schooling by determining the time required for promotion to third class rating by Hueneme honor men and for personnel failing or barely passing Hueneme's course.

This study has shown that overemphasis of formal educational processes is easily obtained and that little success is being obtained in civilian institutions in training skilled workers. It is again stressed that the formation of a workable apprentice training procedure is worthy of investigation and deserves early attention in spite of the obvious difficulties involved.

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